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ABSTRACT

The focus of this seminar was on how teachers learn to teach learners with diverse backgrounds and learning styles and what they need to know to be effective instructors. The following papers were presented: (1) "What Teachers Need to Know about Learning" (Robert E. Floden); (2) "Teaching Children: What Teachers Should Know" (Alonzo B. Anderson); (3) "Teachers, Schema, and Instruction" (Siegfried Engelmann); (4) "Culture and Teaching: What Do Teachers Need to Know?" (Carl Grant); (5) "Cultural Embeddedness: The Role of Culture on Minority Students' Acquisition of English Literacy" (Henry Trueba); and (6) "What Teachers Need to Know about Cultural Diversity: Restoring Subject Matter to the Picture" (G. Williamson McDiarmid). (JD)

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Conference Series 89-1

Competing Visions of Teacher Knowledge: Proceedings From an NCRTE Seminar for Education Policymakers

February 24-26, 1989

Volume 2: Student Diversity

National Center for Research on
Teacher Education

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Conference Series 89-1

COMPETING VISIONS OF TEACHER KNOWLEDGE: PROCEEDINGS FROM AN NCRTE SEMINAR FOR EDUCATION POLICYMAKERS

February 24-26, 1989

Volume 2: Student Diversity

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National Center for Research on Teacher Education

The National Center for Research on Teacher Education (NCRTE) was founded at Michigan State University in 1985 by the Office of Educational Research and Improvement, U.S. Department of Education.

The NCRTE is committed to improving teacher education through research on its purposes, its character and quality, and its role in teacher learning. NCRTE defines teacher education broadly and includes in its portfolio such diverse approaches as preservice, inservice, and induction programs and alternate routes to teaching.

To further its mission, the NCRTE publishes research reports, issue papers, technical series, conference proceedings, and a newsletter on contemporary issues in teacher education. For more information about the NCRTE or to be placed on its mailing list, please write to the Editor, National Center for Research on Teacher Education, 116 Erickson Hall, Michigan State University, East Lansing, Michigan 48824-1034.

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Many papers published by the NCRTE are based on the Teacher Education and Learning to Teach Study, a single multisite longitudinal study. The researchers who have contributed to this study are listed below:

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Preface

Mary M. Kennedy

A popular pastime today is to develop lists of what teachers need to know. Such lists can have a settling effect; by enumerating all the elements of good teaching, we have cleared up at least one of life's many confusions. But in fact, these lists do not solve very much, for each entry on each list is complicated in itself. Every researcher who has tried to define teacher knowledge, every policymaker who has tried to measure it, and every teacher educator who has tried to enhance it, knows the myriad problems and perplexities that are bubbling underneath the surface of each entry on these lists.

Like many others, The National Center for Research on Teacher Education (NCRTE) has also been struggling to understand the nuances of these entries. The Center is trying to learn how teachers learn to teach academic subjects to diverse learners. In light of this mission, the Center is especially interested in two particular list entries: "academic subjects" and "diverse learners." These two entries make nearly everyone's list, but like other entries, their full meaning has yet to be determined.

On February 24-25, 1989, in Washington, D.C., the NCRTE sponsored a conference for educational policymakers to examine these two entries. For academic subjects (Volume 1), we focused on science, mathematics, history and writing; for student diversity (Volume 2), we focused on student cognition and on student cultural backgrounds. Rather than seeking out one authority in each of these domains, we sought three. And we sought people whom we expected to view their assigned topics from diverse perspectives. Our goal was to delve deeply into each topic, to understand each topic in far more depth than is permissible at the level of list entries. So, for instance, we viewed student cognition from the point of view of Vygotskyian theory, conceptual change theory, and behavior change. And we viewed writing from the viewpoint of a teacher, a researcher, and a disciplinarian.

The papers in this volume derive from that seminar. Among other things, we discovered that the conceptual struggles within these fields were not as diverse as one might expect. Instead, there are a small number of tensions that seem to be repeated in many different fields. Both science educators and writing educators, for instance, are torn between defining their subject as a body of content and defining it as a way of thinking and behaving. Both mathematicians and historians find it difficult to convince novices that their knowledge is tenuous, not fixed. People in all four of these fields experience a tension between the way the subject is perceived by its most advanced thinkers and the way it is perceived by naive students.

Among other things, we all became aware of the struggles and tensions within each field, of the difficulties of defining ideas, and of the many faces each of these fields really has. Seeing each field portrayed from a variety of perspectives was interesting and intellectually stimulating in itself. Seeing analogous dilemmas emerge across such diverse fields made the conference particularly stimulating. In fact, it was especially so for the speakers who represented the various disciplines, for many of them had never had the opportunity to examine another field very closely. The opportunity to do so enabled them to better understanding conflicts within their own fields. Our hope is that, by making these proceedings available to others, we can provide a similar experience for a broader group.

Acknowledgments

I would like to acknowledge the organizational talents of Joan Eadie who organized the conference in Washington, D.C., the thoroughness of Sandra Gross for tracking and editing the proceedings papers, and the perseverance and dedication of Anna G. Edridge and Kris Langham for preparing the individual papers for publication in this volume.

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WHAT TEACHERS NEED TO KNOW ABOUT LEARNING

Robert E. Floden[1]

A year ago I was leading a class of about 20 students preparing to teach. Their program was organized so that I was working with a group that had indicated a special affinity for mathematics. Either they were mathematics majors planning to teach math in high school, or they were elementary education majors who saw mathematics as one of their favorite academic subjects. Somewhere in the discussion I asked them to think back to their own experiences in mathematics, either in secondary or elementary school. When I asked whether they had found mathematics difficult, most of them said "no," though perhaps they really had to do a lot of work. This was no surprise--these students were in this group because they liked mathematics. Then I asked them whether the *other* pupils in their elementary and secondary classes had found math hard. They didn't think so.

That *is* surprising. Many elementary and secondary school pupils do find mathematics difficult, puzzling, even mysterious. Though it might be possible that these students all had such outstanding teachers that all students found mathematics easy, it is more likely that these students were wrong about how difficult other students found mathematics. That error in perception was of little moment while these students were pupils. But when they become teachers, a similar misperception about their students can lead to the awful, but all-too-common situation in which the teacher explains the concept accurately, then can't understand why many pupils don't get it.

Often, these teachers will attribute the lack of learning to insufficient student attention or motivation. If the problem persists, the teacher may learn that some pupils won't learn from their teaching, but attribute this to innate differences among pupils. "Some people just aren't good at math. It doesn't matter how many times you go over it. They just don't get it." If extreme advocates of subject matter knowledge for teachers observed the class, they might reach the same conclusion. The explanation was clear (to the observer), so any failure to learn must be the pupil's fault.

This scenario, repeated in teacher education programs across the country, contributes to the problems of schools where little learning takes place, even when the teachers are devoting time and energy to their instruction. One root of this problem is that these teachers have difficulty imagining how their instruction looks to their pupils, how they perceive what they are studying and what they are supposed to do, or how they learn content which is in some ways new or foreign to them. If teacher education could turn this situation around, teachers might begin to realize that success in teaching depends on having the content make sense to the pupils. Having it make sense to oneself or to a colleague is important, but insufficient.

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[1] Robert Floden is associate director of the NCRTE and professor of teacher education and educational psychology at Michigan State University. His expertise is in philosophical studies of teacher education and educational research.

The bulk of the paper will argue teachers should understand how pupils use their existing knowledge to make sense of what is going on in their classroom. Teachers who understand this idea, even in a general way, will more likely be aware of ways in which pupils might misunderstand content that seems clear (even obvious) to the teacher, and will more likely make the effort required to see whether pupils *understand* what they are studying.

In later parts of the paper, I will show how teachers could generalize from this knowledge about *pupils* to get a better appreciation of how *they* are learning to teach, and about how *scholars* in the disciplines change the body of accepted knowledge.

Schema Theory

When pupils engage in the tasks of schooling, they try to fit what they are experiencing into their current knowledge and understanding; that is, pupils make sense of instruction in ways that depend on what is already in their minds. Because pupils know different things than teachers do, pupils' interpretation of instruction may differ from what their teachers intend. Psychologists use the concept of "schema" to organize what they know about human perception, learning, and memory (see, e.g., Alba and Hasher, 1983; Anderson, 1977, 1984; Thorndike and Yekovich, 1980). Schemata (i.e., more than one schema) are organized general descriptions or rules for how to act in particular situations. They can be thought of as prototypes of things or things to do, outlines for which the specifics can be filled in.

Associated with each schema are various particular characteristics or qualities that provide specific instances of the general schema. For example, a pupil may have a schema for "worksheet" that indicates that worksheets have writing on them, include tasks that the pupil must do, are printed on ditto paper, and so forth. The pupil's knowledge about specific worksheets is organized around this general description. Or the pupil may have a schema that governs what to do when the teacher leaves the room. This might include checking for the presence of other adults, and doing different things depending on whether or not other adults are present.

Pupils' knowledge of the various school subjects, like mathematics or social studies, is structured around schemata. In mathematics, the pupil might have a schema for arithmetic operations that involve two numbers. The schema would indicate that an operation takes a pair of numbers and gives a third number as a result. As pupils become more sophisticated, the schema might become elaborated to include the idea that the order of the two numbers may or may not make a difference (i.e., $2 + 3 = 3 + 2$, but $2 - 3 \neq 3 - 2$) or that some pairs of numbers may not correspond to any third number (e.g., $7 \div 0$ is undefined). Schemata are important because of the role they play in comprehension and recall. When pupils encounter something new, they attempt to interpret it by means of their existing schemata. Once a likely match is found with a schema, the pupil will attempt to fit all aspects of the new information into the structure of this schema.

Pupils who begin to study division, for example, may try to fit it into their schema for a binary mathematical operation (Davis, 1984). This seems a promising framework for interpretation, since division involves two numbers and yields a third number as a result. It appears easy to make sense of this new concept to be learned. "It is just like the things we already studied." The particularly sophisticated pupil will wonder whether order makes a difference or not, and perhaps whether any number keeps things the same, in the way that zero functions for addition (any number plus zero is that same number) and 1 for multiplication (any number times 1 is that same number).

In the absence of some schema that provides the framework for incorporating new information, comprehension is difficult, if not impossible. Let me demonstrate this by asking you to consider the following passage:

> If the balloons popped the sound wouldn't be able to carry since everything would be too far away from the correct floor. A closed window would also prevent the sound from carrying, since most buildings tend to be well insulated. Since the whole operation depends on a steady flow of electricity, a break in the middle of the wire would also cause problems. Of course, the fellow could shout, but the human voice is not loud enough to carry that far. An additional problem is that a string could break on the instrument. Then there could be no accompaniment to the message. It is clear that the best situation would involve less distance. Then there would be fewer potential problems. With face to face contact, the least number of things could go wrong. (Bransford and Johnson, 1972, p. 719).

Most people find this passage confusing. The individual sentences all make sense, but they seem to be sentences from a variety of different stories. Just when it seems that it is starting to make sense, the next sentence seems to go off in a new direction. This illustrates how instruction in a new area might seem to a child with no framework that can serve to organize and interpret what is going on.

Now look at the following figure of a modern Romeo, using helium balloons to lift the speaker for his voice and guitar playing to the level of his Juliet's apartment window. Suddenly, words like "wire" and "instrument" that seemed to refer to some scientific apparatus take on new meaning. The passage above, read with this illustration to give an overall framework, suddenly makes complete sense.

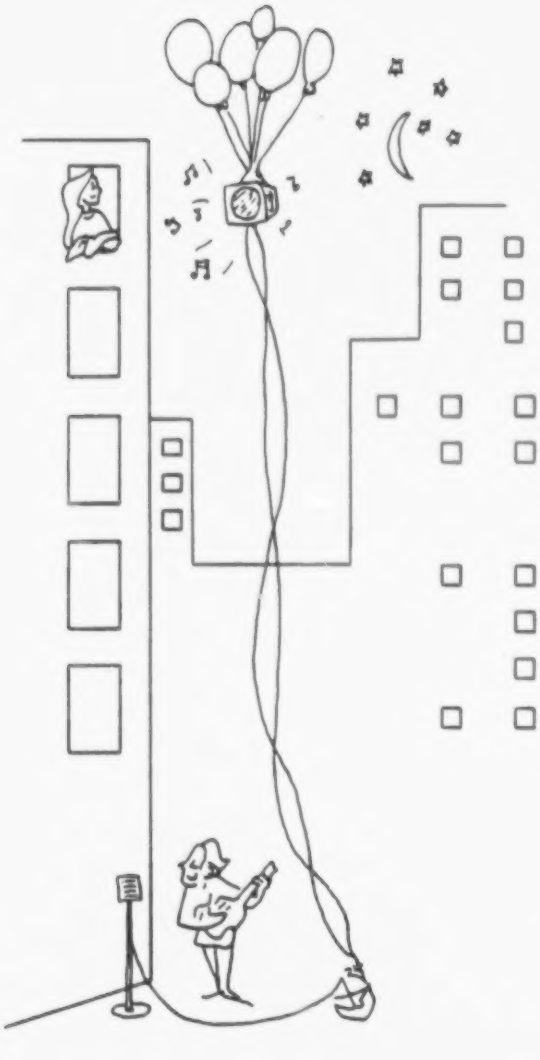

Figure 1. A modern day Romeo scene (Bransford and Johnson, p. 718).

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Although comprehension is difficult without a schema, it may still be possible for pupils to cope with some of the exercises teachers could pose for them. Consider the following passage (for which Judy Lanier gets credit):

> It is very important that you learn about traxoline. Traxoline is a new form of zionter. It is montilled in Ceristanna. The Ceristannians gristerlate large amounts of fevon and then bracter it to quasel traxoline. Traxoline may well be one of our most lukized snezlaus in the future because of our zionter lescelidge.

No student could make sense of this passage, though the sentences all seem to be written in English.

Now consider the following worksheet questions:

> *Directions*: Answer the following questions in complete sentences. Be sure to use your best handwriting.
> 1. What is traxoline?
> 2. Where is traxoline montilled?
> 3. How is traxoline quaselled?
> 4. Why is it important to know about traxoline?

Students could perform well on this worksheet without understanding the content. If they did perform well, the teacher could have no way of knowing whether the students had schemata that enabled them to fit the content into some framework of meaning, or merely a schema for completing exercises like these. While this example is nonsense, the same pattern--lack of understanding, "adequate" performance on assignments, lack of clear signals that something has gone wrong--might well occur if the initial paragraph had been about real concepts such as photosynthesis, metabolism, and oxygen-carbon dioxide cycles.

These examples illustrate the role that schemata play in initial comprehension. They provide the structure that is used to give sense to information and events. Let me now show how schemata have a more extended role. Consider the following story:

> Susan welcomed her friends. She was smiling as she opened the packages. After she blew out the candles, they all ate ice cream and cake. They played some games before they had to go home.

When children are asked what is going on in this story, they usually say that it is about a birthday party. Many of you probably have the same impression. If you look back at the story, however, you will notice that the story never says this. What the children have done is to fit the information that is there into their schema for birthday party, then used that schema to elaborate what they actually read so to complete the structure they are using for interpretation. This illustrates how schemata not only provide a way of organizing new information, but also provide a way of elaborating, of adding to, that information according to the sense assigned to it. Further examples from reading comprehension are easy to construct. Anyone reading with reasonable speed does a lot of filling out of information at the levels of letter recognition, word recognition, and sentence comprehension. Likewise for listening to the teacher or to another pupil.

Interpretation and elaboration take place as information is recalled, not just as it is incorporated initially. Research going back to the 1930s (Anderson and Bower, 1973; Bartlett, 1932; Black, 1984; Schank and Abelson, 1977) has demonstrated that as people recall stories, they arrange and elaborate them so that they make more sense than when they were first heard. Details that do not seem to fit are forgotten. Other details are added to complete the overall structure. Discrepant events are revised or omitted. In school instruction, this means that pupils' schemata continue to play an active role in their understanding, even after initial instruction is completed. When trying to remember things about topics studied earlier, the information is not recalled as it was seen then or even as the pupil made sense of it then, but as it now makes sense in terms of current ways of organizing facts and concepts. So the pupil who now has an active schema about the way geography affects life in a region will seem to remember relationships among geography and life in Africa, even though that schema may not have been used to make sense when doing the social studies unit on Africa.

What difference would it make for teachers to know the importance of schemata for comprehension, elaboration and recall? From what I have described so far, the most likely difference would be that teachers who appreciate the importance of schemata would recognize that pupils will be able to understand and remember things that go on in their class only if they have some framework that organizes or connects the bits and pieces. Teachers would probably ask themselves whether their pupils had an appropriate framework for interpreting the work at hand, and if not, would provide them with one.

This would be consistent with the admonition, incorporated into many teacher evaluation systems, that the teacher should provide an advance organizer. Indeed, the research basis (e.g., Ausubel, 1968; Mayer, 1979) for that requirement is of a piece with the research supporting my claim. But understanding the point of providing an advance organizer (rather than just learning the rule that the teacher should always provide one) allows the teacher to judge what sort of organizer would be helpful, or whether one is necessary at all. If pupils already have an appropriate schema available, the teacher need not spend time elaborating a framework.

So far, I have assumed that pupils either use an appropriate schema or have difficulty because they lack a schema. A frequently occurring third possibility is that the pupil uses an inaccurate or misleading schema. Pupils do not enter the classroom with empty heads, or even with open minds. They already have many schemata that have been elaborated as they tried to make sense inside and outside school. Some of these schemata incorporate patterns or relationships that distort or contradict the beliefs that the teacher hopes the pupils will learn. A common, though not trivial, example is that most young pupils probably believe the earth is flat; teachers and geography books give a different message. Or pupils may think that what makes a poem good is whether or not it rhymes.

Common sense indicates that instruction ought to dispel these ideas. Schema theory adds the insight that, as long as these beliefs persist, pupils will use them to make sense of new information they encounter in class, with resulting distortions. Pupils tend to interpret instruction to fit what they already know, rather than trying to modify their existing knowledge or to create new schemata. (For examples in science teaching, see Driver, Guesne, and Tiberghien, 1985; for example in mathematics teaching, see Davis, 1984.) Thus, for example, pupils hearing about the U.S. presidential system will tend to assimilate the relationship between the president and congress into the set of relationships for which they have schemata, for example, parent and child, teacher and pupil, or boss and worker. But none of these prototypes appropriately represents the U.S. system of checks and balances. Hence any successful assimilation to one of these schemata will require distortion.

The danger of distortion provides an important reason for teachers to attend to pupils' schemata. To avoid such distortion, teachers must either see that pupils make a good selection of a schema or create situations that will bring pupils to alter their schemata. Let me describe an extreme case of such distortion, a case which usually makes a strong impression on the undergraduates I teach.

Benny was a fifth-grade mathematics student nominated by his teacher as someone who was doing well in mathematics (Erlwanger, 1973). The teacher's assessment was based on Benny's strong performance on the examinations provided with the individualized mathematics curriculum Benny had been using for several years. A researcher interviewing Benny was surprised when he claimed that 1.2 was the same as 1/2. When asked to explain this, Benny talked about his understanding of mathematics and of the testing process. Answers on the test, he said, would only be counted correct if they matched the answer key. Thus, if the key said 2/4 but you wrote 1/2, you would get it wrong, even though you knew that the two answers were equivalent. In the same way, 1.2 might be counted wrong if the key said 1/2, though the two were equivalent. Mathematics, said Benny, was just a collection of unrelated rules, one rule for every test. Once you figured out the rule for a particular test you could do those problems. But you had to start from scratch again for the next test.

Benny was unusual. His case suggests what is possible, but is more extreme than what teachers typically experience. But teachers regularly encounter the problem that pupils' inappropriate schemata--sometimes called subject matter misconceptions--create problems in their interpretation of instruction. Teachers with little understanding of schema theory may not realize that the problem exists.

For an everyday educational example, let me return to pupils' initial belief that the earth is flat. Teachers need nothing more than common sense and a bit of experience to realize that pupils may often enter with this belief. An understandable teacher response would be to give the pupils a more accurate belief, backed with some rationale. So a fifth-grade teacher might have the pupils read about Columbus's voyage or might tell them about how the earth looked to astronauts out in space. On a quiz, the pupils might then indicate that they now believed that the earth was round.

But this apparent instructional success could be deceptive. In a study of two second-grade classes, Nussbaum and Novak (1976) interviewed pupils who had been through a sequence of instruction on the earth's shape. Many children interviewed would begin by saying that the earth was round like a ball, but as the interview continued it became clear that it would be more accurate to say that they believed the Earth was flat.

> It would be a mistake, however, to infer that their answers are meaningless to them. Each child hears about the Earth's spherical shape from different sources. Failing to understand its real meaning, the child attempts to make some sense of it for himself . . . Some examples of this sort are the following.
>
> (a) Daryl . . . was asked, "Why do people say that the Earth is round like a ball?" His answer was, "Because sometimes roads go in circles around trees in parks."
>
> (b) Chris . . . answered the same question as follows: "Because the Earth is round on hills and mountains."
>
> (c) Other children answered the question, "Which way do we have to look to see the Earth?" by saying, "We have to look up to the sky." Further probing revealed that they believed that there are two Earths. The one they live on is flat, and the other, which is round like a ball, is a kind of planet in the sky. (p. 542)

In summary, it is important for teachers to understand that pupils actively impose sense, both on their current environment and on their own memories. Because pupils' schemata are not those of the teacher, they may make different sense of instruction than that intended by the teacher, and they may put things they have learned together in ways the teacher finds misleading or even mistaken. If teachers understand this principle, they will be more likely (a) not to assume that satisfied pupil faces mean that pupils have learned what the teacher hoped they would learn, (b) consequently to do more to probe the understanding of at least a sample of pupils (more about this below), (c) to attempt to take pupil's current knowledge into account in planning instruction, and (d) to assume that, because students may have different schemata, they will have to represent the subject matter in more than one way.

Learning and Schemata

Knowing that schemata affect understanding and recall is important. Even more important for teachers is understanding learning. Three things need to be understood: (a) how to help students draw on appropriate schemata; (b) how to lead students to exchange inappropriate schemata for better ones; and (c) how to assess students' understanding and then identify schemata they are using. In the first case, the teacher who understands how having access to an appropriate schema enhances proper understanding and recall will construct lessons and tasks to increase the chances that pupils make an appropriate selection from among their current schema. In the second case, teachers who appreciate the difficulty of altering schemata should use procedures for conceptual change teaching, such as confronting pupils with ways in which their schemata do not adequately represent the world, helping pupils see that other schemata might overcome this problem, and providing support that may be needed as the shift is made.

Linking Instruction to Existing Schemata

In many cases, pupils come into a teacher's class with knowledge of concepts and their relationships that are reasonably accurate. Whether gained through instruction in a previous school year, through interactions with parents and other adults, through personal experience, or through independent reading, the pupils begin instruction with some reasonably accurate general framework for understanding; that is, the schemata that they bring to the classroom are appropriate enough to serve as the basis for further learning of the subject. In this case, the teacher's job is to help the students activate those schemata so that they can be used to interpret and elaborate new information provided during instruction. Possession of an appropriate schema is of little use if the pupil does not use it when the occasion arises. The pupil might even use a different, less appropriate, schema, rather than the one that the teacher sees as the proper framework for understanding the lesson at hand.

The actions that the teacher should take to activate the proper schemata are consistent with common sense. They include beginning instruction with a framing statement or example, drawing explicit links back to prior instruction (where the schema was originally learned or used), and asking the students to state what they see as the "big ideas" in what they are studying. In each of these cases, the intent is the same--to help the students retrieve the appropriate schema from memory. In many cases this will be easy, because the current learning context is similar to ones in which the schema was previously used.

In other cases students will have difficulty recalling the proper schema or deciding which of several possible frameworks is the one they should use. That would likely be the case if the schema had been learned in a context quite different from that of current instruction. For example, a student might have schemata about habitat that had been learned in science. Those schemata might be appropriate for thinking about the physical environment of a country considered in social studies. But, without the teacher's help, the student might not bring the schemata to bear, because the context of studying science seems so different from that of studying social studies.

What is important for the teacher to know in such situations is that students will understand and remember better if they use the appropriate organizing principles they have already mastered to make sense of what they are learning. This requires subject matter knowledge of appropriate ways of organizing and interpreting content. These have been discussed in other papers at this seminar. Here we are concerned with what teachers need to know about *student learning* in order to help the students use those schemata. Teachers need not know that these organizing ideas are called "schemata," but they do need to know that students need guidance in figuring out which organizing principles are appropriate.

An example will illustrate how teachers should translate this knowledge into classroom action. Imagine a teacher about to begin teaching her sixth graders a unit on photosynthesis. (For a more detailed discussion of teaching photosynthesis for conceptual change, see Roth, 1985.) One of the organizing principles for the unit might be that plants, like animals, need food to provide energy for growth and the operation of the systems of the organism. Some especially important ideas are that food gets transformed to waste material, that it may need to be processed by the organism, that the organism may store food for later use, and so on.

Many pupils may enter the class with a reasonably accurate schema for food, learned in the context of studying about animals. But the pupils may not think to try to use this schema to interpret what they are learning about photosynthesis in *plants*. If they do use the schema, they will be looking for substances that the plant uses for energy, may store, will convert into waste material and so on. But it will not be easy for pupils to see that this schema learned in the context of studying animals is appropriate for plants as well. In fact, pupils will typically instead use the everyday schema that food is anything that a living thing takes in. This everyday schema is problematic because it does not allow pupils to distinguish between the carbon dioxide the plant takes in (which is *not* food) from the starch stored in roots or seeds (which *is* food).

The teacher with no understanding of the importance of activating students' proper schemata might begin instruction by describing the different activities the pupils would be doing or how much they will enjoy the work with plants. This might give students an idea of what things they will be doing and might provide some motivation to participate in the instruction. But it will not make it any more likely that the pupils will recall the previous framework they had for thinking about food. The danger is that the pupils either will have little means of organizing what they are learning or that they will use some organizing principles that do not support what they should be learning about photosynthesis.

The teacher who understands the importance of using the right schema, on the other hand, will begin the instruction in some way that will remind pupils of the frameworks they already have and that will indicate which frameworks will be best to use in the instruction to follow. For example, the teacher might begin by reminding the pupils of their study of animals and of what they had learned about food for animals. This might be done by the teacher recalling what the pupils had done, or might be done by asking pupils themselves what they remembered about food for animals. Why do animals need food? How does it help them? Do they use all the food they eat right away? What happens to the food as it is used?

The teacher might continue by saying that the unit coming up will help them to understand how the ways plants get, store, and use food are similar to or different from those for animals. They will see that plants get their food in a different way, but that the ways they store and use it are similar. The teacher might also suggest that pupils think about how what they learned about food does or does not fit the case of plants.

I have made this a bit heavy-handed to get across the idea that teachers have many things they can do to help students recall schemata that they already have and to decide whether or not to try to use a particular schema to make sense of instruction. What an expert teacher would actually do might be more subtle, for there are motivational advantages to leaving things unsaid as a unit begins. What I have described may recall the use of "advance organizers" (Ausubel, 1968). Properly used, advance organizers will typically serve to activate appropriate schemata. It is important to note, however, that not all introductory statements about the lesson to follow will serve to activate the proper schemata, though someone observing the teacher might count them as advance organizers.

It is not enough, for example, simply to list the topics that will be covered during the lesson or unit. A list may help pupils to keep track of what topic they are supposed to be working on, but the list may not have the structure that would be best for understanding, recalling, or applying the content. For example, the teacher might begin the unit on photosynthesis by mentioning the different activities that will be part of the unit: growing plants in the dark and in the light, learning about the cycle by which plants make starch from water and air, and learning what makes plants green. This is informative, but will not call up the principles learned when studying animals.

How Schemata Change

Teachers have it relatively easy when pupils come with the right schemata. Teaching is much more difficult if pupils come with schemata that are inappropriate for interpreting the upcoming instruction. In this case, the teacher must somehow get pupils to change their schemata, a task much more difficult than merely reminding pupils to use the frameworks they have. The great human ability to make sense of new information creates the obstacles to changing schemata. Pupils are good at reconciling what they see or hear with what they initially believe, but the reconciliation often grossly distorts the new information.

Recall the previous example about learning the shape of the Earth. The example is striking because the pupils were able to sit through instruction designed to change their view about the shape without making any fundamental shift in their initial beliefs. Each of the pieces of evidence intended to change their views was reinterpreted in a way that preserved those views. Moreover, the pupils were able to make these changes in ways that hid their persistent flat-earth views from the teacher, thus making it even more likely that they would continue to be able to hold them.

To change pupil's schemata, it is helpful if teachers know something about current thinking on the conditions under which such change is likely. It is usually not enough to describe the appropriate schemata or to do work designed to gradually build up the proper understanding; something more dramatic is required. The term, "conceptual change teaching," is used to describe an approach designed to confront directly the problem of how to get pupils to revise their initial basic conceptions of a subject area. The inspiration for this method comes both from Piaget's description of the importance of cognitive conflict for conceptual reorganization (e.g., Piaget, 1971, uses the term, "accommodation") and from the historical and philosophical literature on how basic conceptions ("paradigms") changed over the history of science (e.g., Kuhn, 1970).

According to Posner and his colleagues (Posner, Strike, Hewson, and Gertzog, 1982), getting pupils to make a fundamental change in their schemata requires (a) that they be dissatisfied with the current schema, (b) that they are able to understand an alternative schema, (c) that the alternative seems initially plausible, and (d) that the alternative seems like it might be fruitful in trying to apply it to new situations. Creating dissatisfaction means that the teacher must bring to pupils' attention some of the ways in which their current schemata do not fit either with other things they already know or with things they are experiencing or learning about in class. Thus, for example, pupils' ideas that poetry is something that rhymes might be called into question by having students look at nonrhymed verse in a poetry anthology. Though this experience alone will not be enough to get pupils to shift to a different schema for thinking about poetry, it might be enough to create some dissatisfaction with the current schema. Dissatisfaction is more likely if the teacher explicitly draws pupils' attention to the discrepancy between what they believed about poetry (i.e., that it rhymes) and the information that doesn't fit this belief (i.e., that this piece is in a book of poetry, but doesn't rhyme).

In trying to create this dissatisfaction, it is especially important that teachers know how to figure out what students currently believe and how to keep track of their attempts to reconcile current beliefs with new evidence. In the example of the shape of the Earth, the teacher may well have expected that learning about Columbus's voyage and the flights of the astronauts would be enough to bring about dissatisfaction with a flat-earth theory. But the pupils' creative strategies for reinterpretation probably removed their discomfort. To counter this tendency, the teacher would have needed to figure out what beliefs the children adopted, so that the problems with those beliefs could be brought out. Dissatisfaction with initial schemata is insufficient, however. Unless the pupils have some reason for adopting the schema that the teacher thinks appropriate, they will either cling to their initial beliefs or come up their own--possibly inappropriate--new schemata. To get pupils to switch to the appropriate organizing framework, the teacher must make this seem attractive.

At the most basic level, the teacher must help the students understand the schema. If they do not understand it, they can hardly be expected to adopt it. Once they understand it, pupils must have some reason for thinking that it will be a worthwhile. From the pupil's perspective, being worthwhile means being something that helps to remove the dissatisfaction produced by the current schema, as well as being something that seems likely to be useful for further learning. Thus the teacher needs to know the importance of not only getting pupils to understand the appropriate schema, but also helping them see the comparative advantages of this schema, both in resolving current difficulties and in learning about other topics. Again, the abilities to give this explanation and to show comparative advantage depend on knowledge of the subject being taught. Knowledge of schema theory makes teachers realize what sort of explanations are required, especially that simply presenting students with the schema to be learned is unlikely to be effective.

To return to the example of teaching photosynthesis to sixth graders, many pupils may think that water and soil are food for plants. The teacher knowledgeable about schema theory recognizes that this framework for thinking about plants will interfere with students' understanding of the need for photosynthesis to *make* food. If the plant can simply absorb food from the soil, it has to need to make it, hence no need for light. The teacher with no understanding of how schemata change might simply explain the process of photosynthesis to the students, perhaps using experiments to make the need for light vivid. The teacher with an understanding of how schemata change, however, will begin by finding out what pupils believe. If they believe that water and soil are food for plants, the teacher might do an experiment that demonstrates that plants grown in the dark soon die. The teacher would then try to create discomfort with the initial beliefs by pointing out to the pupils that the plants had plenty of water and soil, yet died.

This latter teacher would also introduce the theory of photosynthesis as an alternative way of thinking about how plants get their food--plants manufacture their food from water and carbon dioxide, using light as the source of energy. The teacher would show the comparative advantage of this theory by helping the pupils to recognize that this alternative explains why plants in the dark die. Furthermore, the teacher might show how this explains other things, like where the energy that all living things need gets into the food chain in the first place. Or the teacher might simply tell the pupils that thinking about food for plants in this way will be helpful in their later study of plants. Understanding how schemata change leads the teacher to go beyond simply giving a clear explanation, to giving the students good reasons for changing their beliefs.

Determining Pupils' Schemata

A theme that should be clear from the preceding sections is that teachers' knowledge about schema theory will lead them to address their instruction in part to the conceptions that pupils bring with them to instruction. Recognizing that schemata will affect the interpretation of instruction or that teachers must make pupils dissatisfied with misconceptions will be of little moment unless the teacher has some way of determining the substance of pupils' schemata. The great attraction of everyday beliefs about teaching and learning is that they do *not* require much initial assessment, except to avoid redundant instruction. They assume that if teachers explain a concept clearly, pupils will learn it; that if teachers have pupils practice a skill, the skill will be mastered. Schema theory is more challenging because it suggests that instruction may fail if the teacher has not taken account of how pupils might misinterpret it.

Learning about a pupil's understanding. The solution to this problem of initial assessment probably seems obvious: Give a test. Over the last half-century, schools and teachers have increasingly relied on pencil-and-paper "objective" tests as an efficient method of determining what schoolchildren know. The problem of how to decide what pupils know seems to be one of selecting from the rich array of available tests. Test developers have, however, been successful mostly at writing items that assess recall of facts and proficiency in simple skills. Testing pupils' understanding of central concepts has proven difficult, and the selection of tests reflects the relative difficulty of testing in these different domains (Fredericksen, 1984). Tests that would go beyond giving a simple "yes" or "no" answer to whether a student understands a concept are rare. Yet determining pupils' schemata requires knowing more than whether the pupils have already mastered an area; it requires knowing *how* pupils *currently think.*

It is no accident that most educational tests concentrate on a child's knowledge of facts and skills, rather than on the organization of knowledge. Asking the child to name the capital of New Mexico is a reasonably good way to find out whether that information can be recalled. No similarly straightforward question will get at the way the child sees the concept of "food" in a constellation of other knowledge and beliefs. Asking children to describe their own organization of knowledge will not work, because people know many things without being able to give an analytic description of their knowledge.

Kenneth Strike (1977) put it eloquently when he said that trying to determine the structure of children's minds from talking with them is like trying to describe the economy of Manhattan on the basis of the traffic going over the bridges and through the tunnels. It is clear, however, that one learns more from in-depth interviews with children about a topic than from looking at their performance on a multiple-choice test. Think again about the Earth example. Those pupils would respond on a multiple-choice test that the Earth was round, yet the in-depth interviews show that "round" has various nonstandard interpretations.

Two examples should give some idea of the problems with having teachers rely on commonly available tests to assess pupil understanding. In a test of simple reading skills, many pupils in Southern California were shown pictures of objects and asked what sound the name of the object started with. One item showed a picture of a castle. A researcher interviewing some of the children who gave the incorrect response, "D," found that the children thought the picture represented Disneyland.

The case of Benny (Erlwanger, 1973), discussed earlier, is a striking example of how a teacher might drastically misread a student's understanding if a readily available test is used as the means of assessment. Recall that, on the basis of his test performance, the teacher had recommended Benny as someone who was doing *particularly well* in math. Yet Benny had ideas about mathematics--both conceptual understanding and computation--that were wildly off base. Such tests are an efficient way of getting some information about student performance, but they are typically of limited use for deciding what schemata pupils enter with. They are especially weak in providing information that goes beyond whether or not the pupils seem to have already learned a particular concept.

Researchers who carry out inquiries on the operation of pupil schemata have relied on clinical interviews to assess pupils. By posing several problems to a pupil, then asking for explanations, elaborations, and illustrations, the investigator is often able to get beyond whether or not the child is able to produce the set of key words associated with a topic of instruction. Is this interview technique a device teachers might also use? Unfortunately, clinical interviewing is prohibitively time consuming for a teacher who must work with classes of 20, 25 or more. As a conservative estimate, it might take a teacher 15 minutes to interview a child on a single concept. Interviewing every child on a single mathematics concept might then take two weeks of the time regularly set aside for math instruction. Knowledge of schemata would be of little use if the teacher had no time for instruction.

Knowledge of common preconceptions. One way out of this dilemma is to recognize that, though individual pupils may have some idiosyncratic beliefs, particular schemata are widely shared, at least in broad outline. The belief that the earth is flat, for example is common among fourth graders. It is common enough, in fact, that the teacher would not go far wrong to plan instruction on the assumption that most children shared this belief. This simple example illustrates one way of solving the problem of needing to have some idea of pupils' conceptions, but not having time to probe for them. If teachers learn some of the common conceptions that students bring with them to school, the teacher can (tentatively) assume that many pupils in class share these conceptions. Experienced teachers sometimes learn such common conceptions over their years of experience with different classes.

Note that the common conceptions indicated here are not Piaget's stages of cognitive development, though those stages are similar in being an indication of ways in which many children of a certain age may think. Piaget's stages are probably among the most widely taught principles of educational psychology. But these stages are too general to be of much use in teaching elementary school children. If teachers are aware of the specific conceptions pupils bring to the study of a given topic, they have little need for additional knowledge of the Piagetian stage the child is likely to occupy.

Learning to probe student responses. Another strategy for learning about the schemata pupils are currently using is to probe the understanding of a few pupils, assuming that they represent the class as a whole. It resembles the previous approach in trying to orient instruction toward commonly shared conceptions, rather than taking into account the conceptions of every child or even the details which may differ among children who share a general conception. It goes beyond that approach, however, in trying to determine the conceptions held by *this particular* class, rather than assuming that this class is like every other class at the same grade level. It also has the advantage of not requiring the teacher to remember the common schemata for every topic taught and of not forcing the teacher to wait until research has documented commonly held schemata for a wide variety of topics. Current research has seldom gone beyond a few topics in science taught in the upper grades. Knowing some of the schemata that are likely to be held would still be an advantage, however, because it would make it easier for a teacher to draw inferences from brief interactions with a pupil.

One fairly easy way to probe for pupil understanding is to ask pupils occasionally to explain the answers they give. It is surprising and sometimes dismaying how often pupils will reveal their idiosyncratic interpretations when they try to give an explanation that goes beyond repeating the text. Asking, "Could you explain that to the rest of the class?" is likely to get beneath the surface of a student's response.

Instructional problems with probing student responses come, not so much from difficulty in posing questions, as from the difficulties that arise as a result of posing them. Asking students to explain something tends to slow the pace of interaction, especially when pupils are not familiar with such questions as a part of instruction. A reduced pace can create management problems if other pupils begin to let their attention wander as their classmate works to formulate an answer.

Probing for understanding also makes the course of instruction for the day less predictable for the teacher. What direction to move the class depends on what schemata pupils seem to have adopted. If the schemata is inappropriate, the teacher must plan how to show the inadequacies of the schema, without the luxury of a few minutes of quiet thought to plan the next move. So being able to probe for pupil understanding requires knowing how to cope with the uncertainty that comes with confronting what pupils actually do understand.

Some Side Benefits of Understanding Schema Theory

Teachers' primary benefit from understanding schema theory is that they will be better able to help pupils learn subject matter. But understanding of how schemata affect thought and of how schemata change also transfers to other areas of teachers' work, especially to their own knowledge about teaching and their understanding of the disciplines they teach. The transfer to these areas may not be of enough importance *in itself* to warrant teaching teachers about schema theory, but it is a valuable extra benefit.

Learning to Teach

Because schema theory applies to all human learning, it applies to teachers as they learn how to teach. In particular, teachers enter their teacher preparation with firmly entrenched schemata about teaching. Lortie (1975) has pointed out that teachers have spent 12 or more years in classrooms observing teachers and teaching. That extended apprenticeship of observation builds firm ideas about the purposes and methods of teaching. These schemata about teaching will then be used by teacher education students to interpret their teacher preparation experiences. Like the firmly held naive conceptions of children, teachers will be more likely to reshape their experiences to fit their preconceptions than to abandon their ideas.

Like naive conceptions in other subjects, however, many of teachers initial conceptions do not correspond to what research studies have documented about classroom processes. As I mentioned at the beginning of this paper, my own teacher education students enter their program believing that all students have been and will be more or less like they were. They will find the same content easy or difficult and will have the same learning habits and motivations. That egocentric view will be difficult to change without teacher education experiences that highlight conflict with evidence from the classroom and make an alternative view more attractive.

Teacher educators will benefit by recognizing such a role for schemata in learning to teach. But how will such knowledge help teachers? It helps by providing an impetus for them to reflect on how they are learning to teach. Teachers have an advantage over their pupils in having a degree of intellectual development and maturity that makes it easier to consider reflectively how they learn, and consequently to plan ways to improve their learning. If teachers recognize that they probably have preconceptions about teaching that interfere with their ability to see other possible interpretations, they can begin to search for evidence that might suggest problems with those preconceptions or even begin to imagine how events might be differently interpreted from a different perspective. If teachers realize that changes in their schemata will be difficult, and only achieved by confronting contradictory evidence, they can make a mental effort to take possible discrepancies seriously, to entertain the possibility that other perspectives on teaching might have advantages. Thus, teachers who understand schema theory can profit by applying the theory to their own learning. This self-referential application can also make vivid the ways in which schemata operate in the lives of their pupils.

Scholars' Schemata

Schema theory is not merely a theory of learning; it is also a theory of knowledge. It addresses issues of the connections among an individual's beliefs and between beliefs and the experiences that provide support for those beliefs. As a theory of knowledge, it can shed light on the ways in which the content of school subjects is supported through the work of scholars in the parent disciplines. Other papers at this seminar have emphasized the importance of having teachers understand the bases of knowledge or the methods of inquiry in the subjects being taught. Knowledge of schema theory can help teachers appreciate that disciplinary knowledge does not grow simply by slowly excavating facts and piling them on the mountain of knowledge. Scholars, like everyone else, are guided by the schemata they use to make sense of new evidence. For scholars, like pupils, learning things by fitting them into the existing schemata is easier and more common than changing the schemata themselves.

Students entering teacher education, like most young adults, think of the content of school subjects as the conclusions that have been "established," rather than as an active field of inquiry which scholars play an active role in constructing. Unless teachers themselves come to appreciate that knowledge is a human construction, they are likely to teach their subjects as a rhetoric of conclusions. Understanding how schema operate in the learning of their pupils can help teachers see how they might affect the scholarly activities of mathematicians, scientists, and literary critics.

Take, for example, the idea that schemata shape the interpretation of evidence. The everyday view of the work of scholars is that they gather evidence, that they observe the facts, in order to draw generalizations. But "facts" in the sense of things unambiguously given in the world, do not exist. Scholars must use their existing mental frameworks to make sense of experience. Stanley Fish (1980) provides a graphic example from literary criticism. One year he was teaching two classes, one on linguistics and literary criticism and one on 17th century English religious poetry. At the end of the first class one day, he wrote on the board a list of noted figures in linguistics as part of an upcoming reading assignment.

Jacobs-Rosenbaum
Levin
Thorne
Hayes
Ohman (?) (p. 324)

The question mark indicated that Fish wasn't sure of the spelling of this name.

Before the next class came in, Fish drew a box around the list of names added a page number at the top, both hinting that this list might have been taken from a book. When the students entered, Fish told them that the list was a poem like those they had been studying and asked for an interpretation. Using the schemata they had for analyzing poetry, the students saw this list of names not as a list at all, but as a poem.

> The first student to speak pointed out that the poem was probably a hieroglyph, although he was not sure whether it was in the shape of a cross or an altar. This question was set aside as the other students, following his lead, began to concentrate on individual words, interrupting each other with suggestions that came so quickly that they seemed spontaneous. The first line of the poem (the very order of events assumed the already constituted status of the object) received the most attention: Jacobs was explicated as a reference to Jacob's ladder, traditionally allegorized as a figure for the Christian ascent to heaven. In this poem, however, or so my students told me, the means of ascent is not a ladder but a tree, a rose tree or rosenbaum . . . an obvious reference to the Virgin Mary. . . . Levin [was seen] as a double reference, first to the tribe of Levi . . . and second to the unleavened bread carried by the children of Israel on their exodus from Egypt . . . . The final word of the poem was given at least three complementary readings: it could be "omen," especially since so much of the poem is concerned with foreshadowing and prophecy; it could be Oh Man, since it is man's story as it intersects with the divine plan . . .; and it could, of course, be simple "amen."
>
> In addition to specifying significances for the words of the poem and relating those significances to one another, the students began to discern larger structural patterns. It was noted that of the six names in the poem three--Jacobs, Rosenbaum, and Levin--are Hebrew, two--Thorne and Hayes--are Christian, and one--Ohman--is ambiguous, the ambiguity being marked in the poem itself (as the phrase goes) by the question mark in parentheses. . . . The structure of the poem, my students concluded, is therefore a double one,

> establishing and undermining its basic pattern (Hebrew vs. Christian) at the same time. (Fish, 1980, pp. 324-25)

Thus (budding) scholars in a field, like pupils, will bring schemata to bear in trying to make sense out of new information placed before them. (For discussion of the parallels between pupil learning and the growth of scholarly knowledge, see Gibson, 1985; Petrie, 1981.) Like pupils they, too, play an active role in establishing new beliefs. The image that scholarship is the mere accumulation of new "facts," which were always there to be found, is no more accurate than the image that school learning is the mere absorption of the knowledge laid out by the teacher or in the textbook. A more accurate picture makes the process one in which the current state of knowledge or belief plays a central, dynamic role in the continuing process of change. Scholars, like students, need to understand and internalize the methods and standards of inquiry in a field in order to channel their interpretations in productive directions.

Conclusion

I have argued that teachers should understand how pupils use their existing knowledge to make sense of what is going on in their classroom. Teachers who understand this idea, even in a general way, will more likely be aware of ways in which pupils might misunderstand content that seems clear (even obvious) to the teacher, and will more likely make the effort required to see whether pupils *understand* what they are studying. Knowledge of how the current set of mental schema influence what is learned, and knowledge of conditions under which schemata are likely to change, can also be applied to interpreting the ways people other than pupils learn. Two sorts of nonpupils professionally important to teachers are scholars in the subject field and the teachers themselves.

Schema theory may seem so commonsensical and obvious that it hardly seems worth spending time on teacher education. Many teacher education students would probably give verbal assent to these principles. But many teachers continue to give lectures that only make proper sense to pupils who already know as much as the lecturer, and to limit checking for understanding to a cursory "Any questions?" Perhaps what teachers need is the disposition and skill required to act on their knowledge of schema theory. I suspect that many, however, do not really believe that pupils could misinterpret what goes on in class, except through lack of effort or attention.

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TEACHING CHILDREN: WHAT TEACHERS SHOULD KNOW

Alonzo B. Anderson[2]

While preparing my response to Robert Floden's discussion of schema theory, I had two recurring thoughts. My first thought was related to the question which organized this panel: "What do teachers need to know about student learning and prior knowledge of school subjects?" My thought was that no one really knows this in advance. Rather, teachers must *discover* what their students bring with them to the classroom. More important, teachers must have the particular skills and knowledge that will enable them to simultaneously discover and elaborate student knowledge.

My second thought was that, while Floden presents a theory about student learning and knowledge which is different from the theory I find most useful in assisting students in their learning process, there is much that I agree with in his discussion. For example, I agree with his theoretical assertion that students store and retrieve their past experiences. I also agree that students and teachers typically enter the teaching/learning interaction with different conceptions of the educational task to be performed as well as their respective roles in that interaction. Finally, I agree that probing plays an important role in the process of teaching and learning.

Learner as Externally Oriented

However, we diverge on the critical question of the dynamics of the students' information processing during the teaching/learning interaction. Floden presents a conception of the learner as being internally oriented; selecting appropriate responses from a structure that resembles a filing system. In contrast, I conceptualize the learner as being externally oriented. I view the learner as one who is active and assertive in the situation. Instead of comparing new information to existing information, or organizing and reorganizing rules of appropriate responses, I see the learner constructing meaning. I see students making meaning in the process of constructing a theory of their world and their roles in it.

Indeed, these thoughts, questions, and perspectives all grow out of my preference for thinking about teaching and learning in relationship to a zone of proximal development (ZPD). The notion of a ZPD is from the work of L. S. Vygotsky, based on a sociohistorical theory of development (Vygotsky, 1978, 1962). In essence, a ZPD focuses on an individual's potential growth within a specific domain rather than on his or her prior experience. This conception of teaching and learning provides a chance for teachers to examine "change in progress" without being overwhelmed by differential past experiences among the learners.

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The unit of concern in a zone of proximal development is neither the process of teaching, nor the product of teaching. In this approach, teaching and learning are interdependent and are considered as a whole. The unit of analysis is the change over time in the way the task is achieved as the student and the teacher interact with dual motives: doing the task and promoting the child's achievement with respect to the task. Before commenting more fully on the zone of proximal development, I would like to comment on an old idea regarding the relationship between home and school and then to allow that idea to suggest what I think teachers should know about student knowledge and learning.

Bringing Home Into School

An old idea can be resurrected to represent my view of what teachers should know about students' knowledge and learning. The phrase "in locus parentis" sums up the view. According to the old idea, schools were expected to act "in the place of parents," albeit the old interpretation concerned mostly the education of the moral character of the child. My view is that the school should act in the place of the parents, providing continuity with the educational environments that parents, family members, and the child's community provide--(a) continuity with the educational events that involve the world around the child, and (b) continuity by providing for an educational environment that prepares the child to return to that world with a better theory of it--prepared to act within it.

This notion is not equivalent to "start where the child is" as some constructivist views would suggest that we do; rather, like John Dewey, it calls for starting where the out of school environment leaves off and for preparing to send the child back out of school, the better for being educated. The school is a special environment in our own and many other societies--time and place is set aside (Cole and Griffin, 1987). We make jokes about ivory towers and theorists. But in industrialized nations, schools are where educational activities designed to help a child carry out the process of constructing a useful theory of the world (and being effective in that world) are supposed to take place. As educators, I think it is important that we don't lose sight of this fact. We bring students from home and community settings (where they spend the majority of their time) to the school so that we can help prepare them to eventually make their own home in the world community.

This perspective suggests that what teachers must need to know about student learning and student knowledge about school subjects is the manner by which they learn and acquire this knowledge when they are not in school: What math concepts do they use and how do they use them? When and how do they practice literacy? Is there such a thing as "everyday chemistry"? And if there is, how does it relate to school chemistry? I would, therefore, like you to keep this notion of bringing the home into the classroom in mind while I focus the remainder of my comments on what I consider to be the essential theme of Floden's comments--*teaching effectiveness is based on teacher knowledge of their students.*

In particular, I wish to comment in more detail upon Vygotsky's theory and what he says about the intra-psychological processes of students--what Floden might refer to as schema and schemata. It is interesting to note that most schema theorists, and other theorists as well, hold that background knowledge has a very important impact on student knowledge and learning. Therefore, in the process of discussing ZPD theory, I will also comment, using a sociohistorical perspective, on just how "background knowledge" or culture, might influence what pupils learn and how they learn. In this connection an important question is, "How much do teachers need to know about the background knowledge students bring with them to class?" Finally, I will comment on the things teachers need to know in order to carry out effective teaching/learning interactions.

Theoretical Background: Vygotsky's Zone of Proximal Development

The sociohistorical school of psychology based on Vygotsky's work offers a way of understanding the development of student knowledge and skills. Vygotsky viewed the development of all higher psychological processes (that which we now call cognition) as being fundamentally social in nature. From this perspective, the structure of the developmental process is intimately linked to the structure of social interaction. Vygotsky proposed that developmentally, any higher psychological function appears twice, on two planes. First it appears on the social plane, in the context of social interactions, and then it appears within the individual child, transformed into a cognitive process. Thus, culture or "background knowledge" plays a very important role in cognitive development, because it shapes the child's experiences and forms of social interactions.

Vygotsky was interested in how children come to be able to guide and direct their own actions when solving a problem or completing a task. He believed that the development of this control was not simply a function of age, maturation, or direct instruction, but rather that skills, strategies, and forms of thought are acquired as children interact with adults and peers in specific problem-solving situations. Vygotsky argued that children arrive at a point where they can solve problems (e.g. math, science, literacy, etc.) independently because they have in the past solved that problem, or a similar one, with help and guidance from others. The social organization of experience, or culture, creates a medium for development.

The social context in which new skills are learned can be organized in the form of a Zone of Proximal Development. The zone is a metaphor for the range between what a child can do independently, and what a child can do with help from others. The zone is the link between the two planes, interpsychological and intrapsychological. It is generally accepted in education that assessing students' initial level of knowledge is important so that instruction can be aimed at a slightly more advanced level. If instruction is aimed at the students' current level, the work is too easy and the children do not learn. If instruction is aimed at a level which is too advanced, frustration ensues and the children do not learn.

Rather, instruction should be aimed at the intermediate "soft spot," where learning can be maximized. In this way, education *leads* development. The zone is adjusted "upward" as the learner develops so that the learner can move toward independent functioning by internalizing the means by which the teacher regulates the learner's behavior. The learner internalizes the *kind of help* that has been provided by others, and uses the same means of guidance to direct him or herself. Culturally elaborated skills, that is, those skills that are valued and arranged for by a culture, have social origins in two senses. One is that the actual *procedures* are learned through social interaction, such as how to divide one number by another, decode a string of alphabetic symbols, or mix a chemical compound. In addition, the *motivation* for the use of these skills is social in origin (for a further discussion see McNamee, 1987).

In Vygotsky's view, educational activity takes place within a zone of proximal development created by the teacher and the learner. He used the ZPD to assess not only the cognitive potential of individual children but also educational practices. Like clinical teaching, the ZPD allows for the assessment of intrapsychological functioning within the interpsychological realm of activity in which cognitive growth occurs (Wertsch, 1985). The ZPD as an educational context is ideal for the assessment of students' knowledge and their approach to learning because interpsychological functioning is an essential requirement for educational activity.

The Zone of Proximal Development in a Nonschool Setting

Based on this perspective, I can suggest that one of the things teachers need to know about student knowledge and learning is *how* they have been successful in learning activities that occurred outside of school. Earlier, I suggested that we may learn how to act in place of parents by developing a better understanding of the educational events involving family and community members that occur in nonschool settings. I have drawn one such example from a large corpus of data collected during my ethnographic study of literacy development among low-income families in San Diego, California. However, before I describe the event itself, I would like to describe the context of the event, including the setting, the educational materials (a chemistry set) involved, and the participant structure of the event.

Overview of the setting. The example is taken from observations of a Black family participating in the literacy study mentioned earlier. We were studying the middle child in the house, Elliot (9 yrs.) who lives with his mother and two brothers, David and Tyrone (ages 5 and 11). The example however, involves an interaction between the mother's sister, who was babysitting, and the three boys. During the observation period when the event occurred, Tyrone and his two brothers were being taken care of by their Aunt Ruth (age 23). The aunt suggested that they bring out the chemistry set which she had given them for Christmas.

Chemistry set. The chemistry set used in this interaction is a product of Skilcraft and it is recommended for ages nine years and older. Its contents are (a) a manual containing 250 experiments and their procedures, (b) five bottles of chemicals, (c) three test tubes and a rack to hold them, (d) a test tube clamp, (e) litmus paper sheets, (f) a chromatography booklet, (g) a metric chart, and (h) a table of elements. The back of the chemistry set container displays a periodic table of elements and a metric conversion table.

Each experiment has a set of procedures specified in the manual. In general, any given experiment has the following set of phases: (a) a preparation phase, (b) an assembly phase, and (c) a completion phase. The manual is typically consulted in the preparation phase to select an experiment and specify the materials necessary to carry it out. Most of the specified equipment and materials are contained in the set, but on occasion it is necessary to use some item which is common to most households (e.g., pliers, sugar, scissors, etc.).

Once the necessary equipment and materials for a particular experiment are set up in the preparation phase, the different goals in the task serve as a checklist. The assembly phase is typically characterized by the selection and measurement of ingredients and mixing the items, using the necessary tools. The completion phase is where the desired end state of the experiment is accomplished, given that all went well. This phase typically ends with cleaning up the work area.

Sequence of the events. The time is about 6:30 p.m. Ruth, Tyrone, and David are watching T.V. (while David simultaneously practices his balance on his bicycle equipped with training wheels). Elliot is in another room (out of everyone's view). During the commercial between T.V. shows, Ruth makes a suggestion to Tyrone.

6:32 p.m. Ruth: Why don't we play with the chemistry set I got you guys for Christmas?

Tyrone: O.K., I'll go get it (Leaves the room).
(Suddenly, a crash is heard from the kitchen.)

Ruth: Elliot, what are you doing!

Elliot: Nothing.
(Ruth gets up, seeming a bit agitated, and walks to the kitchen. Elliot has broken a bowl. Ruth gives him a scolding and instructs him to clean up the mess he's made. Ruth supervises while David looks on.)

Preparation Phase In the meantime, Tyrone has brought out the chemistry set and puts it on the dinning room table.

6:35 Tyrone: (Takes out the manual and looks through it briefly.)

6:40 Ruth: So, which experiment should we do?

Tyrone: (Makes a suggestion)

Elliot: No, I want to do the _ _ _ _ experiment. (Elliot makes his suggestion as he approaches the dining room table after leaving the kitchen.)

David: No.

Ruth: Come on, you guys, can't we agree on just one? (The discussion about which experiment to do goes on for awhile. Ruth tries, but fails to get the boys to reach a consensus. After several attempts, Ruth selects the _ _ _ _ experiment. The boys accept her selection without contest.)

Assembly Phase

Ruth: (Consulting the manual) First we have to find the cobalt chloride. Elliot, why don't you get that for us?

Elliot: (Following his aunt's instructions, Elliot begins looking through the various chemical containers, apparently reading the labels.)

Ruth: (Still consulting the manual) We're going to have to have some sugar and sulphur too. I'll get the sugar. Tyrone, you get the sulphur. (With that instruction, she goes to the kitchen.)

Tyrone: (Picks up and begins to read the manual.)

Elliot: (Still looking through the chemical containers) Ty, is this sulphur?

Tyrone: (Looks up from the manual and reads the label) Yeh. (Tyrone takes the container and places it on the table. Then he goes back to reading the manual.)

Ruth: (Returns from the kitchen with a small container of sugar) Elliot, you still looking for the cobalt chloride?

Elliot: Yeh. I can't find it.

Ruth: C-O-B-A-L-T C-H-L-O-R-I-D-E. I know you can find it. David, come measure this sugar for me.

Elliot: (Again searches the chemical containers, picks one out) Ty, is this cobalt chloride?

Tyrone: (Puts the manual down and takes the container from his brother) Yeh.

Ruth: We need four measures of sugar. This is how you make one measure. (She demonstrates for David.)

David: (Continues the operation, making four measures of sugar.)

Ruth: What's that you have there Tyrone?

Tyrone: I've cobalt chloride! (He had actually started the measuring operation earlier, when Elliot found it.)

Ruth: We need a half measure of sulphur.

Elliot: (Begins to measure the sulphur as Ruth observes him and the other boys.)

6:57 Ruth: Half a measure, Elliot. That's close enough.

Elliot: (Upon completion of his operation, Elliot then turns his attention to his brother David. He tackles David and they begin to wrestle.)

Tyrone: (Watches as Ruth begins to assemble the ingredients the boys have measured.)

Ruth: Got some thread, Tyrone?

Tyrone: Yea, just a minute.

Completion Phase

Ruth: (Ruth completes the experiment and puts the final results on the table. She calls the younger boys back to inspect their creation. Finally, it is time to clean things up. At this point, the boys run off and Ruth is left alone to take care of things.)

In summary, it was demonstrated that across the three phases of the task, Ruth mediated each of the boy's contribution to the experiment. She selected an experiment in Phase I, selected ingredients for each participant, and ended up cleaning up the mess. She constrained each boy's contribution differently, providing as much help as she felt was necessary.

Protocol Analysis

The transcript of the discourse was recorded with paper and pencil by the ethnographer. It is very difficult to make straightforward claims about cognitive processes with this kind of data, but some interesting questions are brought to bear in a simple analysis. Out of 18 verbalizations recorded in the excerpt presented, 12 are generated by Ruth. All but the last of them relates to the task of organizing the activities of the kids.

If these notes were to tell us anything about what anyone is thinking, wouldn't they be telling us about what Ruth thinks each child is capable of doing in this task? When Ruth spells out the words C-O-B-A-L-T C-H-L-O-R-I-D-E, does it not say something about the implicit theory of the task that she thinks Elliot is up against? We must assume that she meant it to help him. What would she have to assume about how Elliot goes about his finding the chemical in order for her to believe that it would help?

She certainly does not assume that Elliot is a good reader, because if he was, there would be no reason to spell the words out. The sound of the words alone should be enough for a good reader. Consider that it would be insulting for her to say this to Tyrone who is older and more experienced. On the other hand, she cannot assume that Elliot cannot read at all, because if this were the case, he could make no use of the letters. As a demonstration, just consider if she had said it to David. It surely would not help him.

What theory of his abilities and the task facing him could Ruth have in mind? And is it a reasonable one? There are fourteen letters in the words she spelled. Could Elliot be expected to remember those 14 letters while he made the search? If they did not have some internal structure for him, he obviously could not. A successful search for a label with 14 unrelated digits on it is a very difficult task. So Ruth either doesn't recognize any limits on a short-term memory (a strong possibility) or she assumes that Elliot does not recognize some structure in the sounds of the letters (a stronger possibility). Personally, I think it is a elegant example of a child being steered through his "zone of proximal development." Finding the chemical unassisted may be beyond him, but Ruth is providing (a) encouragement to try, and (b) a strategy (i.e. actually spelling it out). In fact, it is my guess that Elliot cannot hold all those letters in his head, but he probably can hold the first several of them, and that should make his search a lot easier.

Dynamic Teaching

Background Knowledge

The crux of the problem with specifying what teachers need to know about students' knowledge and learning lies in the conception of teaching and learning as two separate and measurable activities, assumed to be relatively stable across content domain, time, and setting. Previously, we reviewed a theoretical approach and an educational event that occurs at home, both suggesting that education is a dynamic social process. Specifically, teaching and learning are interdependent elements in a single unit of activity. The implication of such a view for teaching is to turn away from efforts to *control* for the influence of culture (i.e.,"background knowledge") in practical and cognitive activities and to turn toward dynamic teaching procedures (which involve the liberal use of probing) that capitalize on the content of the activity. Such a procedure should involve the frequent use of probing. In this way the students' abilities and "background knowledge," can be assessed while they are acquiring *new* concepts and skills.

The goal of dynamic teaching is to see not only what students can do today, but to get an idea of how they are doing what they are doing and to estimate the potential paths of learning and development. These issues are important not just in the teaching of so-called basic skills but in any area where the desirable skills need to be flexibly applied in new situations.

Examples of Use in Special Education

The dynamic teaching approach can be found in the field of special education, where assessment of the specific nature of individual differences in learning and thinking are more important than comparisons with a normally distributed population. In special educational settings, dynamic assessment techniques have been used to distinguish a lack of achievement due to the absence of previous experience from lack of achievement due to some inherent or organic deficiency. In the former case, it would be inappropriate to use standardized tests, which assume equal access to developmental and educational opportunities. Dynamic assessment of individual strengths and weaknesses is frequently found in clinical evaluations. Brown and French (1979) provide an interesting review of Soviet work on the development of dynamic assessment in special education.

In the United States, Johnson and Myklebust (1967) call the use of dynamic assessment *clinical teaching* because the child is assessed while being taught new skills or concepts. Clinical teaching engages the individual being evaluated in a joint activity with a more competent other, the clinician. The clinician introduces a new concept or skill into the joint activity, and watches the ways in which the person under evaluation makes use of the new skill or information in subsequent interactions. Initially, the clinician provides a great deal of support in the form of guidance, modeling, and prompting. The clinician provides the child with opportunities to participate in whatever way he or she is capable, making careful observations with regard to the type and amount of help which most facilitates of the child's learning process.

A highly skilled clinician can also modify the tests or tasks used in more standard assessment. When a child fails to perform at age or grade level the clinician can vary the parameters of the task systematically, changing the output requirements, the modality and the materials used. For example, a child who reads slowly and with many errors may be read to, and questioned about the story, as a way of assessing comprehension skills. If the child were only questioned about the story he or she read out loud, no useful assessment of comprehension or thinking skills could be made. Using these techniques, a skilled clinician can determine the nature of a child's specific learning disability as situated within the full system of the "child reading." Without such techniques, the specific learning disability may become as much a barrier for the assessment process as it is for the child.

Based on similar principles, the Learning Potential Assessment Device (LPAD) was designed by Feuerstein (1979) to aid in the development of specific psycho-educational programs for children in Israel from diverse cultural backgrounds. The device uses I.Q. test-like items in a test-train-test pattern to assess the child's degree of "modifiability." The underlying assumption is that some people, at some time and in some domains of their development, can perform beyond their independent level of functioning with guidance and training. For others, the level at which they can function alone is a valid measure of their potential of performance (see also Brown and Ferrara, 1985; Brown and French, 1979).

The Zone of Proximal Development in Teaching

What teachers need to know about their students' knowledge and learning requires either extensive observation and longitudinal analysis of student performance on any given lesson or a dynamic approach to teaching wherein the stimulation and probing of student responses is used extensively. The paths to facilitating cognitive change in others are numerous and varied and it would be impossible to enumerate the skills required to teach effectively. However, based on Vygotskian theories and studies of teaching, we can extract some essential practices involved in effective teaching, especially regarding the effective teaching of ethnically and linguistically diverse students. Two key points stand out:

1. A teacher must have readily accessible a wide variety of teaching strategies and practices which she or he can draw upon according to the needs of her students; and

2. She or he must be able to apply these strategies effectively in order to create a zone of proximal development in which learning can take place.

The first point is well stated by Jordan (1980):

> What is being advocated here is that the selection of teaching practices be informed by knowledge of the children's cultural background. The process involved can be seen as selecting from a "library" of potentially available teaching strategies and practices, those which are best suited to a particular population of children. It is neither necessary nor desirable to "reinvent the wheel," or to ask teachers to do things which are so unfamiliar to them as to

> make it difficult for them to operate comfortably and effectively in their own classrooms. Rather, what is advocated is the consideration of the full range of good educational practice, and a selection from that range based partly on the fit of the selected practices with the cultural background of the children to be served. (p. 7)

Although Vygotsky's approach stresses the importance of culture in the intellectual development of students, teachers need not learn a specific curriculum or a teaching style for each cultural group they may encounter in the classroom. The task of creating such a curriculum would be as impossible as creating as many culture-specific assessment devices as there are culturally homogeneous groups in the United States. Rather, teacher training must inform potential teachers about the patterns of culture, including their own, that influence the teaching-learning process. Additionally, teacher training must prepare teachers to be open to experiencing and appreciating the history and cultures of their particular students, and prepare them to help their students value their own histories.

The Role of the Teacher in Constructing a Zone of Proximal Development

The importance of the social organization of instruction lies in the fact that the establishment of a shared understanding allows for the interpsychological functioning integral to a zone of proximal development. This aspect of the Vygotsky theory of development has been elaborated by Rommetveit (1979) and Wertsch (1985). Wertsch states:

> Because an adult and a child operating in a zone of proximal development often bring divergent situation definitions to a task setting, they may be confronted with severe problems of establishing and maintaining intersubjectivity. The challenge to the adult is to find a way to communicate with the child such that the latter can participate at least in a minimal way in interpsychological functioning and can eventually come to define the task setting in a new, culturally appropriate way. (p. 161)

The establishment of shared situation definition is necessary for the child to understand the value of the "expert" or adult version of the skills that are a part of the instructional goals. Intersubjectivity is achieved through language and joint activity, which allow each participant to transcend what Rommetveit (1979) described as their different "private worlds" into a temporarily shared social world.

The study of this movement from interpsychological to intrapsychological functioning requires the development of a new methodology. In his article on alternative paradigms in evaluation research, Patton (1975) makes the case for the development of a methodology which is closely related to the phenomenon under investigation. "Different kinds of problems require different types of research methodology" (p. 13). In the study of any learning activity, the unit of analysis has to be the act or system of acts which constitute the teaching/learning process (Leont'ev, 1973; Moll and Diaz, 1985; Talyzina, 1978). Any suggestions offered to teachers regarding what they need to know in order to be most effective cannot be simplified to focus on either the process of teaching alone or the product of the teaching activity. The suggestions must include both. This point is emphasized by Au and Kawakami (1984) who analyzed the dialogue engaged in by a highly experienced teacher in conducting a reading lesson and concluded that

> Process-product distinctions become blurred. It is difficult, if not impossible, to distinguish teaching behaviors directed at developing comprehension skills from those aimed at assessing understanding of the text at hand or establishing propositions. . . . Instruction aimed at the overall development of reading comprehension skills must take place using some text as its raw material. Even though the text may be seen merely as a vehicle for comprehension instruction, and long-term retention of text information is not a goal, ideas in the text are still the topics of discussion. Thus, propositions established in lessons should not only be viewed as ends in themselves, but as indicators of successfully negotiated, and often academically productive, interchanges. (p. 220)

Many researchers have applied Vygotskian theories of learning and development to research on the educational process. A number of these studies have analyzed individual lessons to examine the interaction of the teacher and the students within a zone of proximal development. In many of these studies, the protocol of social interaction in the service of the teaching/learning process is used as data; the discussion is segmented into teacher-student interchanges as units of analysis.

Annmarie Palincsar, together with Ann Brown and others, developed a reciprocal questioning procedure in reading comprehension. In her paper on the role of dialogue in providing scaffolded instruction, Palincsar specifies many aspects of the role of the teacher in creating and maintaining a zone of proximal development for instructional purposes (Palincsar, 1986). Au and Kawakami (1984) also identify effective teaching behaviors related to interactive teaching. Their study also involved a reciprocal questioning technique for teaching reading comprehension skills. The KEEP (Kamehameha Early Education Program) reading procedure has been demonstrated to be extremely effective in raising the reading comprehension achievement test scores of Native Hawaiian children (Calfee et al., 1981). Drawing from Palincsar, Au and Kawakami, and the work of members of the Laboratory of Comparative Human Cognition (1982) in applying Vygotsky's principles to teaching, the following knowledge and abilities are suggested as being essential for teachers to employ in order to create and maintain a productive zone of proximal development effectively.

- Ability to create learning tasks that (a) combine several instructional objectives, and (b) place particular emphasis on the use of skills and concepts which are new to the students or just emerging in the repertoire of the students;

- Ability to assess dynamically the initial "ability" of individuals and groups so that instruction may be aimed above (but not too far above) that level;
- Ability to elicit and sustain student interest by tying activities to meaningful goals, in order to foster intrinsic rather than extrinsic motivation.
- Ability to use modeling, questioning, and direct explanation in order to make the purpose of the task, as well as the execution of the task itself, clear to pupils
- Disposition to be tolerant of responses that are divergent from the teacher's point of view (though the teacher may need to reorganize the activity , or use prompts and questions to redirect the student's thinking when there is indication of little contact being made with students);
- Disposition to give specific praise, acknowledgement, encouragement, and to restate correct responses in order to highlight the relevant information
- Ability and disposition to create and to bring students into classroom dialogue;
- Ability to create and carry out tasks in which students become actively involved with teachers and other students;
- Ability to adjust support based on evaluation of pupil performance; and
- Disposition to withdraw support gradually so that students may gradually increase their independent control over the execution of the task.

Considering this entire list of essential teacher knowledge and abilities, the "ability and disposition to create and to bring students into the classroom dialogue" is perhaps the most important. It is fundamental to what teachers need to know. Without it, the student is relegated to a much more passive role in the teaching/learning process. More important, when teachers do not create classroom dialogue the students are denied the opportunity of becoming *actively* involved in lessons in a manner that will allow the students to use their previous experiences, interpretations, and knowledge.

In the final analysis, we would agree that although many factors influence the outcome of classroom lessons, the teacher plays a most powerful and influential role in constructing the educational context. In carrying out this role, teachers need to know and be sensitive to the patterns of social and intellectual activity that their students have had previous experience with in their homes and communities. It is only on this basis that teachers can successfully learn about the students' other relevant experiences, engage the students in meaningful dialogue and, finally, create with the students a shared understanding of classroom lessons and their outcomes.

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TEACHERS, SCHEMA, AND INSTRUCTION

Siegfried Engelmann[3]

The question this paper addresses is: What should teachers know about learning? I'll try to provide part of the answer in the first part of the paper. The second part expands on some details and focuses on why I would not follow any of Floden's recommendations.

Teachers should have a special kind of knowledge about teaching. That knowledge derives from the ability to execute the details of effective instruction. The teacher should know how to present tasks to kids in a way that makes it very clear that the teacher understands that teaching is acting--acting in a way that is appropriate for the situation. The teacher should demonstrate appropriate pacing, appropriate inflections and stress, appropriate responses to kids who perform well and appropriate responses to kids who make mistakes. The teacher should be able to correct mistakes in a way that is technically sound but that doesn't "punish" the kids. The teacher should be able to demonstrate a range of presentational skills that permit "whole-class" responses and skills in terms of managing kids in a way that promotes hard work and positive work attitudes. The teacher, in summary, should be a technician.

In addition to these skills, the teacher should have the knowledge about diagnosing problems quickly and providing timely remedies. These skills are quite different from the probing and remedies that Floden describes. Rather, the teacher should be able to get information from kids at a high rate and know how to identify problems (based on kid responses) and how to fix up these problems the fast way not by stepping outside the instructional program, but merely by repeating parts of the program that present difficulties to the kids. Related to this diagnostic issue, the teacher should know how to achieve a high criterion of performance, moving fast on activities that kids have already mastered and making sure that all new material is mastered. The teacher should be able to use kids' performance to determine whether kids are appropriately placed in an instructional sequence. (The basic rule is that if a kid is perfectly firm on less than 70 percent of the tasks or activities the teacher presents, the kid is over his or her head. If the kid performs at much above 90 percent correct on "new material," the kid already knows the material and should be placed in a higher level of the program.)

Knowledge Teachers Need

The teacher should have knowledge about the relationship between teaching and kid performance. On a global level, they should know that all kids in a regular classroom can learn the various skills that are supposed to be taught in arithmetic, science, language, reading and other subjects. Teachers should know that dyslexia is a myth, created by those who do not know how to teach decoding to young kids. They should understand that the corrective (remedial) reader is a product of what had been unintentionally taught, that the currently poor performance of kids in math and science represents a gigantic teaching failure--not a kid failure--and that teaching is a precise, logical game. They should know that the kids' responses are mainly a function of the teacher's behavior and that changes in the teacher's behavior cause changes in the kids' performance.

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Teachers should understand why efficiency is important. The idea is to beat the clock to teach more in a specified amount of time so that the kids learn relatively more during that time. Over a school year, the minutes saved each period, each day create a substantial difference in how smart the kids are at the end of the year. Teachers should also know what is not efficient--lectures during which kids simply grow older, time-consuming demonstrations, poorly focused activities that are not targeted on identifiable instructional objectives, and tasks or activities that do not involve *all* the kids and yield responses from the kids at a high rate. (When the responses are at a low rate, the potential for diagnosis is at a low rate, and it becomes difficult to determine who is learning what and who is perfectly lost.) Teachers should be able to discriminate between a "lumpy" teaching sequence and a good one. They should be able to identify the activities that involve untaught skills, and the tasks that are far too ambitious in what they attempt to teach.

Problems in Establishing Knowledge

There are several problems with establishing this knowledge in teachers. The first is that it is impossible to induce this knowledge as knowledge (and not mere verbal tabloids) without a lot of direct experience. Furthermore, the experience must be with programs that have the *potential* to teach all the kids. Because most teachers are trained in traditional teacher-training institutions, they will probably never even observe *good* teaching. They may be fortunate enough to learn some good management skills, but the technology of good teaching goes far beyond these skills, and this technology simply cannot be taught if the instructional programs are poorly designed. The reason is that the instructional sequence is responsible for inducing the appropriate "schemata."

If the sequence is a spiral sequence, like that of the typical math basal, the kids work on a particular topic, like fractions, for a while. Then they launch into a sequence of other topics before returning to fractions. The return may be 60 school days later. Furthermore, the activities are very poorly designed. The number of "taught" examples is inadequate, and the applications prompt kids to figure out their own strategies for working the "practice exercises" that follow. If a teacher tries to teach this program well, the best she'll create are kids like Benny who have been "conditioned" not to attend to instructions, who make up strategies and interpretations that work for the various problem sets presented by the text but that are dead ends. These kids also have incredible deficits in their knowledge (such as not knowing that 1/2 and 1.2 do not express the same value). Benny is *not* an unusual case.

A teacher teaching this kind of program will get nothing but bad information about what good teaching is and how it can change kids. If the teacher made sure that the kids were firm on every "unit" presented in the program, the teacher would not cover very many units, and in the end, the kids would later reveal problems. Similarly, the teacher teaching "fact versus opinion," as it is presented in reading basals, and teaching it well, would do her kids a great disservice because they would come away from the teaching with the misconception that there is some dichotomy between "fact" and "opinion." They would not understand that somebody could say, "I think the capital of California is Sacramento," and that the opinion could express a "truth." Similarly, every topic in science, math, and reading presented by the textbooks most widely used will induce misinformation or "distorted schemata" at a high rate.

Consider the kid learning fractions in a typical basal. The first three fractions presented are 1/2, 1/3, and 1/4. These are studied ad nausea, typically in the third grade. The "strategy" that the kids use to do the various worksheet problems is to count the pieces in the pie or the block. If there are 2 pieces, the fraction is 1/2. The kids usually perform well until they encounter a fraction that does not have 1 as the numerator.

Imagine the incredibly inappropriate schemata that are induced by this introduction. The kids assume that all fractions are less than 1, that they represent a piece of something, and that the top number of the fraction is simply a showpiece that has no significance. Of course these kids will have trouble later. But the cause of the problems they'll experience is the instructional sequence. Before a teacher could get good information about what excellent teaching is, the teacher (or somebody) would first have to rewrite the entire instructional sequence, as well as the instructional sequences for the other "topics" presented in the program.

Curriculum Sequence Causes Misconceptions

One fact that teachers should know is that the curriculum sequence is the basic cause of kid misconceptions. Another fact is that these misconceptions are very costly because reteaching the appropriate concepts or discriminations requires a far greater amount of time than appropriate initial teaching requires. A fifth-grade corrective reader, who has been unintentionally taught to guess at words and to try to figure out what the text says before decoding it, requires approximately 7 times the practice trials to become accurate on confused word pairs (like *a* and *the*). A 10th-grade corrective reader has practiced the inappropriate strategies longer and therefore requires a greater number of trials possibly 12 times the number of trials required by good initial teaching in the first grade.

Finally, teachers should understand the realities of teaching and learning. They should know, for instance, that virtually without exception, major basal programs are *not* written by people who are able to view instruction from the perspective of the kids, are *not* field tested and revised substantially on the basis of problems that kids have with the program, and are *not* consistent with either how kids learn or with what they are expected to learn later. (See the NCTE *Report Card on Basal Readers*, National Council of Teachers of English, 1987.) Teachers should understand that these programs will induce misconceptions at a high rate, but that the solution would be either to scrap the programs or to rewrite them completely. Since neither alternative is realistic, the teacher must do the best that is possible.

Good Programs for Good Teaching

There are instructional programs that permit teachers to learn what good teaching can do. Although these programs are relatively unpopular among traditionalists, they have the potential to work. Certainly a teacher can butcher them because the program's potential is realized only if the teacher is technically good. We use these programs for training undergraduates and graduates.

As the teachers' skills improve, they learn by direct experience how a good activity is designed. They see that all the kids can do it. The teachers also see how much and what kind of practice is *actually* required to induce the various skills that are either taught glibly or not taught in traditional programs. Within this learning context, the teachers gain a precise understanding of how important *their* role is and the enormous difference in kid performance that is created by execution of details of their presentation their pacing, pausing, inflections, responses to kids' responses, use of challenges, and the other technical details of how they communicate and interact with the kids. Because it takes months to teach these various skills to the teachers, I can't go into great detail, but the point is that it is *all* very detailed--no global solutions, no glib formulas.

Teachers who work with well designed programs, and who learn to teach well, became proficient at evaluating instructional programs. They can articulate why various traditional approaches are weak. And to an extent, they can fix up some of the major problems in a traditional program by applying what they have learned by going through effective instructional sequences. However, they are *not* instructional designers and wouldn't be effective without possibly five to eight years more training. But they can teach and teach well. They can diagnose specific problems, both in kids and in instructional sequences.

My description of what the teacher should know about learning is more like what the teacher should know about teaching, because we're not interested in some broad or unspecified category of learning but rather the kind of learning that is caused by teachers. So the focus is on making sure that the teacher has the communication tools and interactional skills needed to do the job. This description is greatly different from that provided by Floden, but there are serious problems with Floden's position.

Major Problems With Schema Theory

I completely agree with Floden's observation that teachers frequently explain concepts accurately but can't understand why many pupils don't get it. I further agree that many teachers who have learned skills are incapable of distinguishing between whether an explanation is clear to somebody who already understands the concept or clear to a naive student who is trying to learn it. I agree that the response of teachers (a response that has been reinforced by the traditional view of education) is to blame the kids, attributing their poor performance to insufficient attention or lack of motivation. Finally, I agree that success in teaching depends on having the content "make sense to the pupils."

I disagree, however, with Floden's solutions to these problems. Here are the major problems with the use of schema theory to alter schemata:

1. It's impossible to teach just about anything in a major subject area without *altering* the schemata that kids have. Furthermore, virtually everything that is taught can be viewed as schema.
2. These alterations are a function of the instructional sequence that is presented not the framing statements and the window dressing, but rather the *details* of the instructional sequence. Distortions that are induced are a function of these details.
3. The proposed probing that teachers are to perform is not efficient and merely identifies problems. Understanding the problem does not guarantee the solution. The assumption that the teacher will be able to use this information to provide an effective remedy is perfectly unfounded.
4. Floden's suggestions for correcting distorted schemata will not work because they don't address the issue of "having the content make sense to the students." If it's true that distortions are a function of the instructional sequence (Point 3), then it follows that the only legitimate solution would be an overhaul of the sequence.

Schema

The first problem is schema and what they are. *Food*, according to Floden, is a schema within the constellation of other facts or relationships. We could therefore argue that any higher order class name functions in the same way--vehicles, buildings, animals, plants, etc. The problem is, Where do higher order nouns end and lower order ones begin? Since these designations are a function of the particular context to which they are applied, virtually all nouns then become potential schema. *Ball* is a schema because in different situations, different balls would be "appropriate." Possibly baseball is a schema, too.

In addition to these nouns are rules that may run counter to experience, like "The earth is round." Is it possible that these are actually *superordinate* schemata of some sort.

After all, we must distinguish between "earth" in the context of the world, not something used for planting things and building dikes. And we certainly don't mean *round* like a disc. In addition to these contextually embedded words is the meaning of the rule itself. Whether or not we consider rules as superordinate schemata, they would be in the class of schemata. But what wouldn't be in that class? We would have to search very far if the apparent criterion for calling something a schema is that it can be manifested in a variety of contexts. Something as elementary as the color purple resides in the sky, in perfume bottles, and in images created by closing your eyes and pressing against the lids (images that have no counterpart in the outside world). So whatever is not a schema must be rote labels of the highest order.

Possibly, it is not fair to try to categorize concepts and relationships as "schemata." Possibly, the valid test is simply whether kids use past knowledge to interpret present learning experiences. If so, then schema theory is perfectly trivial with respect to instruction. We don't need a theory to tell us that we would have great difficulty teaching a kid to add fractions with unlike denominators if the kid had precisely no arithmetic skills (couldn't count, couldn't identify numerals, and so forth). Furthermore, we would quickly discover why "prior knowledge" is prior in instructional sequences. If we attempted to teach our perfectly naive kid how to add fractions with unlike denominators, we would ultimately have to teach the various skills that should have been introduced "prior" to the introduction of this operation (basic equivalence, counting, and so forth) before we could *communicate* efficiently with the kid. If we started with the teaching of fractions with unlike denominators, our communication would obviously come across to the kid as one of the gibberish passages that Floden presents.

The central thrust of how Floden treats schemata seems to be to provide a framing that will mobilize the appropriate knowledge set and guarantee success. It won't work. Here's why: In instruction, schemata are strictly relative to what has been taught and what is to be learned. Nobody has a completely articulated "schema" for "fractions." Some mathematicians might come close, but the properties of fractions are potentially too pandemic to assume a "limit" or a lid on knowledge. Similarly, the kid in the fifth grade doesn't have a complete "schema" or even a set of complete "schemata" for fractions. The kid either has a schema that is appropriate for the applications that are to be presented next or he doesn't. If he doesn't, his "current knowledge" is either incomplete but not distorted, or distorted in some way with respect to what is to be taught next.

The three possibilities are that the kid has perfect background knowledge, the kid has incomplete background knowledge, or the kid has distorted background knowledge. Here's a diagram of the possibilities:

Perfect background knowledge	Incomplete background knowledge	Distorted background knowledge

Note that "perfect background" means simply that the kid has the prerequisite knowledge needed for what is to come next and that what will be presented will perforce *modify the schema.* (If this weren't the case, we wouldn't have to teach kids anything because they'd already know it.)

Since the kid with perfect background presents the easiest case, let's start with that kid. At some point in the teaching, this "perfect" schema will become either incomplete or possibly even distorted, even if the teaching sequence is well designed. But what does schema theory tell us to do about restoring undistorted schemata that incorporate new knowledge? I'm not sure. The summary of things that Floden suggests should happen are reasonable. But the concrete descriptions of what the teacher does are unreasonable. Certainly the new teaching should be linked to the kid's knowledge base, and certainly the teaching would mobilize the appropriate framework (such as adding and subtracting fractions). Since the original schemata are now inappropriate, the kids should obviously exchange inappropriate schemata for better ones. But the kid *doesn't have access to the alternative schema* because it hasn't been taught yet.

When we start teaching the new material, we are creating some form of conceptual change. So possibly, we are supposed to engage in conceptual-change teaching, with circuitous demonstrations to create dissatisfaction and questionable verbal explanations, such as, "This will help you out later." We encounter a problem in applying conceptual-change teaching because we are unable to "help students draw on appropriate schemata." They don't have the appropriate schemata and won't have them until the successful teaching of the new operation has been completed.

The teaching will not necessarily be successful. There are three possibilities: the teaching could be incomplete; it could create great distortion; or it could be perfect. Whatever happens to the students, however, will occur as a function of the teaching, not of any "advance organizers," explanations, or obliquely related demonstration. The framing that is presented through the examples and the tasks that are presented "cause" the schemata that kids come away with. The methods used to change them is what renders the instruction successful, partially successful, or a perfect disaster.

Diagnosis and Remedies

Consider Benny, the fifth grader with great deficits in math knowledge. Through his responses, he indicates precisely what his conceptual problems are. Indeed his description of the causes are probably quite accurate. Benny has been reinforced for winging it, making it up as he went along, and trying to psych out the various worksheets. The problem was instructional because Benny was successful, which means that the worksheets actually reinforced Benny's psyching-out behavior. To fix up Benny, however, it's quite another matter. We could make statements about what we would need to do. We need to modify his schemata. We need to show him the relationship between fractions and decimal values. We need to create a conflict, and we need to resolve it. And we need to do it efficiently.

Here's an effective way of doing it that does not involve any of the conceptual-change steps that Floden suggests; however, it will do everything Floden would like to see done. We introduce problem sets like this one:

Fractions	Equivalent Fractions	Decimals
$\frac{1}{2}$	$\frac{\quad}{100}$	•
$\frac{5}{4}$	$\frac{\quad}{100}$	•
$\frac{3}{4}$	$\frac{\quad}{100}$	•

For each row, Benny is to complete the fraction with the denominator of 100 that equals the first fraction in the row. Then Benny is to write the decimal notation. When we introduce the exercise, we may discover that Benny doesn't know how to convert the fractions in the first column into 100ths fractions. So we'll teach him that. The conversion step is important because it shows Benny that the fractions *are equal*. They are equal because we multiply the fractions in the first column by a fraction *that equals 1* to get the equivalent fractions. Multiplying by 1 doesn't change the value you start with so the fractions must be equal. To convert the 100th fractions into decimals, Benny simply reads them: "fifty hundredths." That's exactly what he writes for the decimal number, .50.

As part of this exercise, we'll have Benny circle the smallest fraction and make a box around the largest *decimal* number. This part of the exercise will challenge Benny's notion that 1/2 and 1.2 are equivalent. He'll see that the "mediator" is the 100th fractions. They provide the conversion and they show that 1/2 can't equal 1.2 because 1/2 is the smallest fraction, and 1.2 is the largest decimal number.

After Benny has successfully performed on some of these tables (for more than one lesson), we introduce a variation that presents *dollar amounts* in the last column. And lo, we have given Benny a new slant on the entire operation. He now sees how decimals and percents interface and how their equivalence works (1/2 dollar is .50; 5/4 dollar is 1.25). Why not introduce the "dollar" link from the beginning, rather than having Benny work the problems "mathematically"? We want to discourage Benny from making any more homemade interpretations. We want to make sure that he processes the full range of fractions including those like 9/5. If we give Benny the green light to think of fractions in terms of dollars, he may come up with a perfectly inappropriate strategy for working the problems.

That's the solution, very simple, very quick, and guaranteed to work. Note that the "dissatisfaction" is short circuited. We simply work with what knowledge Benny has and show him the appropriate *relationships*. We point out the relationship between dollars and decimals, but in this case, after the fact, not as a premise or rule for handling conversions, because we want to establish *the mathematical operation* as the primary one for driving this relationship. The remedy is provided with no windy explanations, no seductions, and no wasted time on activities like counting out money. Yet, when Benny completes the exercises and their extensions to "word problems" and so on, we will have greatly modified his schemata for "money" (because we have enlarged what he already knows into a greater constellation of knowledge that includes equivalent fractions), his knowledge of fractions (because they are now more precisely related to decimal notations), and his understanding of equivalence. All these changes will come about as a function of what we do and how we do it the details of instruction.

Furthermore, if Benny's instruction had included activities like the ones described above, Benny would not have either the knowledge deficiency of how fractions relate to decimals or the notion that the game is to psych out worksheets. The issue is one of instructional design. On issues of design, Floden says simply,

> Students will understand and remember better if they use the appropriate organizing principles that they have already mastered to make sense of what they are learning. This requires subject matter knowledge of appropriate ways of organizing and interpreting content.

So what is left for "schema" theory, except to add "dissatisfaction" exercises that are perfectly unnecessary and inefficient demonstrations? Although Floden provides NO suggestions for preparing Benny, Floden does address some "distorted schemata" problems. For each problem, I'll provide a remedy that I guarantee will work. None of these remedies will resemble what Floden suggests, but I'll also guarantee that his remedies won't work.

The flat earth: From the responses of the kids, we know what kind of instruction they received, mostly rote information. What must be implanted in the kids' head, however, is a "transformation," an understanding of how to relate phenomena viewed on the earth the kids have experienced to "round earth" phenomena. Here's how we do it with *second graders*:

1. We teach major "continents" *using the globe*. As part of this teaching, we present the globe in different orientations so kids get used to identifying North America, for instance, when the globe is upside down. Kids also learn to identify where they are on the globe.

2. We present the relative notion of up and down on the globe by putting a "figure" on different parts of the globe and indicating *up* for that person and *down*. The rule we present: "Down is always toward the center of the earth. Up is always the opposite direction." (We show how a person looks when he "jumps" up from different parts of the globe.)

3. We follow with worksheets that show people on different parts of the globe. For some exercises each person would be holding a ball. For some tasks, kids would draw an arrow to show the direction the ball would move if the person dropped it. For other exercises, kids would draw an arrow to show the direction of the ball if the person threw it straight up into the air.

4. Next, kids would do tasks with the globe that involve going from "continent to continent" or to different places within a particular continent. They would move a figure on the globe, when the globe was presented in different orientations. These would point out that the orientation of globe is perfectly irrelevant to how the "figure" on the globe "looks" (upside down or rightside up).

5. Extension activities involving the solar system, rotation of the earth, and so on, follow.

Note that this sequence would not be presented in a "lesson." Rather, it would be an ongoing activity that spanned possibly 12 lessons but not requiring more than a few minutes each lesson. In the end, the kids will have an understanding of "round earth" that permits them to map what they know about flat earth on the surface of the spherical earth. Note that there would be no studies of Columbus, no looking up in the sky, nothing but a frontal attack on the various relationships (or schemata) that we wish to teach.

Photosynthesis: This example reveals the necessity of instructional design. It also illustrates how kids could have a reasonably perfect schema for instruction that precedes "photosynthesis" but how inappropriate framing and poor instruction could cause incredible problems. Floden asserts that "plants, like animals, need *food* to provide energy for growth and the operation of the systems of the organism." He asserts that "starch stored in the roots or seeds *is* food." Wrong on both counts. The starch is no more food than your muscles, fingernails, or fat are food. They may become "food" for other organisms, but certainly not for you.

Floden's experiment is a classic example of two things you should never do: (a) present an experiment that doesn't prove anything; (b) present an experiment before the fact. We have done a lot of experiments with before-the-fact (or before-instruction) experiments. The bottom line is that even the relatively short ones are a waste of time. Kids either don't remember what happened in an experiment or are unable to relate the experiment to what they learn later. (After all, they do not have the schema necessary to provide a relevant relationship. So it is difficult for them to "store the information without distortion" before they can finally use it.)

In any case, Floden's teacher grows the plant in darkness to show that a plant with plenty of water and soil will die and die soon, according to Floden. And this experiment is supposed to demonstrate that soil and water could not be "food." Obviously, the experiment doesn't show that at all. We hope that there are no smart kids in this classroom because just one of them could raise havoc with this "demonstration." The kid brings in three dead plants. He explains, "I took the first one out of the soil and put it in distilled water, in sunlight. It died in a few hours. I used a hairdryer to dry out the soil in the second one. I put it in the sun. It died in a few hours. I took the third one, pulled it out of the soil, laid it on the dry ground, in sunlight. It died right now."

In the meantime, what is happening to the teacher's plant? It's growing like crazy in the darkness. The reason is that sunlight inhibits stalk growth. In darkness, the inhibition is removed, and the plant grows very rapidly. Does the plant die "soon?" Depending on the plant, and it's dormancy responses, it may live for six months, often for five weeks. So the experiment basically compounds the infraction of trying to teach kids something that is basically not true. The truth is shown largely by the four experiments (the teacher's and those performed by the kid). The plant NEEDS sunlight and raw materials that are provided by water and soil. The plant (or green plants) also need regular air for the carbon dioxide.

How would we do it the right way? We would do what Floden suggests won't work. We teach the kids carefully, and of course, relate what is new to what they already know.

1. We begin with a reorganization of knowledge (or schemata). We indicate that all organisms need two primary things to grow and stay alive: raw materials and energy.

2. We teach kids about energy. Specifically, we teach them the major forms: mechanical, radiant, electrical, chemical, and heat. We also teach the rule that energy in one form can be converted to energy in another form. We give them lots of exercises in which they identify the form of energy that is being shown, and we present conversions from one form to another.

3. We teach basic facts about chemical reactions, illustrating them with things like "burning." The test of a chemical reaction is that you end up with chemicals different from the ones you started with.

4. We apply the rule about what all living things need to grow and stay alive (raw materials and energy) to animals, showing the kids that all the "mechanical" things the organism does use energy (just like a car using up fuel) and that the source of raw materials and *energy* is food. The major raw material that is added to the animal's "food" is oxygen. The organism extracts energy from the food through chemical reactions. The basic reaction is a form of "burning." (You're warm because there's a kind of chemical burning going on inside of you.) Burning is a simple way of saying that the game is to go from higher energy chemicals to lower energy chemicals, which are the ones you end up with when something burns.

5. Finally, we apply the basic needs energy and raw materials to plants. The source of energy is the sun, not food. The raw materials come from soil, air, and water. Enter photosynthesis (which simply permits the plant to convert lower energy chemicals into higher energy chemicals).

Certainly the framing is important. But it is not possible to separate the framing from the instructional design. And the design must take into account where the kids are going from here. We want to teach them always so that what they learn later can be easily related to what they already know so the new schemata do not contradict earlier-taught ones, and do not stand as islands that are unrelated to what had been taught. But the question of how to achieve these links *does not automatically spring from the diagnosis of the problem*. And the remedy is often complicated.

Remedies From Diagnostic Information

For all the examples that Floden presented, I gave instructional remedies that will work if they are developed appropriately. Would I expect a teacher to provide these or other workable remedies? No. Why not? Because I've worked with a lot of teachers, and I appreciate both their problems and their limitations. Teachers typically do not know how to *teach* "concepts," information presented by "rules," or transformations. Typically, the teacher talks *about the concept* or rule, but does not reduce it to the necessary exercises, tasks, and extensions that teach the concept or rule. Once, we presented over 50 teachers with the assignment "Teach your kids the rule that liquids and gases move from a place of high pressure to a place of low pressure." The basic teaching would involve presenting the rule, having the kids say it, then applying the rule to a series of simple examples (diagrams that show the place of high pressure, the place of low pressure), and then having the kids draw an arrow showing the direction of movement. (Other examples show the arrows indicating the direction of movement and require the kids to label the high and the low.)

Not one single teacher did it or even came close. Most talked about the "water cycle" or did some whimsical experiments that did nothing but consume time. None taught the kids.

We don't have to go beyond Floden's paper, however, to discover that a mere identification of the problem does not necessarily imply that a workable remedy will follow. Floden stated the problems, but provided no remedy for Benny, none for flat earth (except to warn the teacher that even after reading about Columbus, kids may have failed to adopt the appropriate schema) and one for photosynthesis that will impart distorted schemata. So effective solutions are not glib and simple. And their complexity raises a serious question about whether teachers should spend time probing. Certainly they will discover problems, but if the identification of the problem does not guarantee an *effective* remedy, the probing may be a waste of time and a cause of the teacher actually teaching less.

Most of the instructional material the teacher uses is hopeless from the standpoint of instructional design. The checklists of "objectives" are a joke. They represent things that are presented in the program, not things that are presented in a way that could possibly lead to uniform mastery. It would be comforting to suppose that the teacher could fix up the programs, but when and how is that going to happen? Will the teacher stay up all night trying to reorganize the curricula so they have the potential to teach? And how is the teacher going to learn how to do it the right way?

Teachers have neither the time nor the training to do it. They typically remain slaves to their instructional programs. In one study that we conducted, even teachers who reported that they deviate extensively from the specifications of their basal reading programs, actually followed more than 95 percent of the program specifications (for the regular part of the lessons, not the "enrichment" activities). The relationship between teacher and instructional program is a lot like that of an automobile driver and car designer. To drive the car, we don't have to know how the carburetor works or the details of the turbulence inside the combustion chambers. Those are the designer's problems. The driver should have a machine that has the potential to perform well in various driving conditions. So it is with teaching. The program designer is supposed to create a "machine" that will work well, if used appropriately.

The programs that we developed have scripted presentations, a feature that strikes traditionalists as being stultifying to the teacher's creativity and ability to interact with the kids. These criticisms are based on distorted "schemata" of teachers, their creativity, and the importance of framing concepts in a way that has the potential for creating unambiguous communication with the kids. Anyone working with teachers on *effective* teaching (a high criterion of performance) would quickly learn about the advantages of scripted presentations and of the details of an effective sequence (such as not spending an entire "lesson" on a particular idea, when information about "learning" shows that kids can't assimilate a great deal of information presented at one time and that by "spacing" the practice over a series of days, kids learn things faster).

Certainly by teaching these programs, the teacher will learn both about the content and about the kids. Warped or greatly distorted schemata will not occur in these programs, which is something the teacher may observe. And, hopefully, there will be the transfer of skills to other situations. Meanwhile, the teacher is not burdened with "probes" because they are totally unnecessary. The performance of the kids on the activities presented in the well designed program provide the teacher with all the information that is necessary to determine if there is a problem.

If the kids do the exercises without making mistakes, there's no problem. If kids make mistakes, there is a problem, but the remedy is straightforward. The teacher does not have to step outside the program, merely repeat exercises or tasks that had been missed and bring the kids to a high level of mastery. If the program is poorly designed and actually teaches something as misleading as, "plants make their own food," the teacher is out of luck. Unless the teacher reorganizes the entire "unit" and throws away the text, the kids will come away with varying degrees of distorted schemata.

Floden's remedies are based on the assumption that what the kids learn is influenced or "caused" by what the teacher does. (Otherwise, why provide the "dissatisfaction" activities, the explanations, etc.?) If this assumption is valid, then probing and after-the-fact fix ups are not the primary solution. The primary solution would be to go back and fix up the programs so they didn't convey distorted schemata and so they effectively induce the relationships and facts that would permit students to learn in an orderly and efficient way. Floden's basic assumption is correct: Kids are lawful. They learn exactly what the teacher teaches, although much of what is actually communicated to the kids is unintentional. If a remedy is effective in correcting a misconception, it should be introduced before the fact as part of the initial teaching to buttress against the misconception.

Since the problem that schema theory is supposed to address is that of organizing content so it makes sense to pupils, and since the curriculum is what determines whether it will make sense or be gibberish, the primary solution must be one of instructional design, not probing, and certainly not practices based on the assumption that the teacher who can't view instruction from the pupil's viewpoint will be able to organize the content so it does make sense to pupils.

In summary, teaching is an act that involves orchestrating many details. Some are details of content, and the content is conveyed primarily by the verbal and nonverbal applications of rules or principles, the juxtaposition of things that are done in the lesson, the amount and use of vocabulary and facts. Through these details an organization is conveyed. If the framework created by the activities in vague, abstract, or unclear, students will employ a variety of "sense-making" strategies, most of which will be inappropriate or distorted. If the design has the potential of conveying the appropriate relationships and discriminations, and if it is continuous with what the kids will learn later, the content is organized so it has the potential to make sense to any kid who is adequately prepared for the program. These design issues are not effectively handled by teachers and do not derive automatically from a description of a "distorted"-schema problem.

Even if the program is well designed and has the potential of making sense to all the students , the design represents only a potential. This potential will be realized only if the teacher is proficient at conveying the information and executing the various behaviors that are needed to make the communication real. This reality occurs only if the students are taught to a high level of mastery (so they are relatively fluent or automatic in applying the facts and relationships), are motivated to learn, and understand that they are expected to learn. The skills that this teacher must have are far from trivial. Relatively few teachers possess them; however, these skills can be taught. And teachers who possess them have a great potential to induce content so it makes sense to pupils.

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CULTURE AND TEACHING: WHAT DO TEACHERS NEED TO KNOW?[4]

Carl A. Grant[5]

My area of teaching and research--race, class, and gender in school and classroom life, and multicultural education--often gives me the opportunity to meet and have discussions with both preservice and inservice teachers. Many of these teachers (and a growing number of policymakers) impatiently demand, "Tell me about the culture of these kids . . . " meaning students of color and poor students. "Give me some tips that will help me teach them." These teachers usually want a recipe for teaching students whom they believe to be culturally deprived[6] or culturally different; or they want a list of "do's and don'ts" that will keep "these students," as they are often referred to, on task. Such lists and recipes do exist as products of the deficit theory and can be found in the educational literature (see, for example, Cheyney, 1967; Kendall, 1983; Morine and Morine, 1970; Reissman, 1962, 1976; Trubowitz, 1968; Webster, 1966). Deficit theories became very popular, gained some academic respectability, and shared a prominent place in the educational debate in the 1960s and 1970s. Although presently they are not put forth as major reasons why students have difficulty learning, these ideas have not been completely dismissed by some educators.

Similarly, other teachers will say, "I have heard that these kids learn differently because they are 'culturally different' and/or 'linguistically different' and are socialized differently from my colleagues [White middle-class] and me. What does research say about the way these students learn and are socialized? Will this information help me to do a better job teaching them? Where can I get this information?" Information on teaching the "culturally and/or linguistically different individual," which grew out of the cultural different hypotheses (see, for example, Baratz and Baratz, 1970) is available, along with applications for classroom use (see, for example, Hale, 1982; Stodolsky, 1967).

The questions above are requests for a remedy to the educational problem of how to teach Black, Hispanic, Native American, and Asian-American students and students whose native language is not English. Many of the teachers asking these questions have very serious intentions and really want to see their (these) students have successful academic learning experiences. How to answer these nagging questions that teachers are raising is the charge of this paper.

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[6] The term "culturally deprived" has been purged from the educational literature, nevertheless, a careful reading of a number of ethnographic studies of schools that include teacher interviews leaves me with the belief that, although the phrase isn't used, its meaning is still communicated. See for example, Grant and Sleeter 1986.

Specifically, the guidelines for the paper instructed me to address "what teachers need to know about how students' cultural backgrounds can influence learning" and I was to "assume that your teacher may be required to work in a variety of schools and must be prepared for a variety of curricula." This was a tall order for one paper; however, the guidelines implicitly more than explicitly cry out, like many of the teachers, for narrow manageable answers that will help them work successfully with a rapidly growing population of students of color (Today's Numbers, 1986). Many of these students, according to Orfield (1987), are being increasingly isolated in the inner city ghettos and barrios from any contact with mainstream American society in a nation that is rapidly moving to two classes--the "haves" and the "have nots" (Harrington, 1984; Kasarda, 1989; Wacquant and Wilson, 1989). Besides the tall order stated in the guidelines, there is, from my perspective, a serious concern accompanying this request. This concern is how such narrow discussions and recipes for educational policy and practice are often used. Social scientists and educators (who are among the "haves") seek direction for social and educational policy and process that will directly impact people of color; these often lead to work that is seriously flawed and causes the victims--"have nots" who tend to be people of color--to be incorrectly understood and portrayed or to be blamed. Ralph Ellison (1966), in a review of Gunnar Myrdal's *An American Dilemma*, spoke to this point:

> Myrdal sees Negro culture and personality simply as a product of a "social pathology." Thus, he assumes that "it is to the advantage of American Negroes as individuals and as a group to become assimilated into American culture to acquire the traits held in esteem by the dominant White Americans." This, he admits, contains the value premise that "here in America, American culture is 'highest' in the pragmatic sense. . . . Which, aside from implying that the Negro culture is not also American, assumes the Negro should desire nothing better than what Whites consider highest." (p. 301)

The testing movement started long ago by Yerkes, Goddard, Thorndike and Termin is another example of the work of social scientists negatively impacting people of color. We will have more to say about the testing movement later. Similarly, scholars of color would argue that the recent Coleman Report (Coleman et al., 1966) is another example of social scientists, in their attempt to help resolve problems confronting people of color, causing as much harm as good (see for example, Bowles and Levin, 1968; G. Grant, 1972; Guthrie, 1972; Mosteller and Moynihan 1972).

My purpose thus far has not been to avoid my task, but to point out that the topic "What teachers need to know about how students' cultural backgrounds can influence learning" carries with it a great deal of historical and contemporary social and educational ferment. This ferment is, in part, conditioned by the different ideologies and points of view that give direction to policies and practices of schools. For the topic to receive the response it needs, it must be contextualized and examined from a point of view that isn't alien or repressive to people of color. This context needs to include a history of schooling from the perspective of people of color, a discussion of the need for teachers to understand their own biography and enculturation, and a discussion of what the literature says (or does not say) about the influence of culture on the teaching and learning of students of color.

People of Color: Individualism, Schools, and Culture

To understand the cultural background of students of color and to teach them successfully, it is important (and maybe even necessary) to have an understanding of how their culture has been and is accepted in school and society. Respect for the culture of people of color has not existed; in fact, cultural disrespect in the form of racism toward people of color began centuries ago and is deeply rooted in the political and social history of our country. Article 1 of the U.S. Constitution declared that representation in the House of Representatives should be based on a population count of the "whole number of free persons. . . . excluding Indians," and "three-fifths of all other persons." Even the passage of the Fifteenth Amendment to the Constitution did very little to foster cultural respect for people of color. In fact, disrespect toward the culture of people of color in the form of racism has been an institution in this country.

Institutions, as understood from a sociological perspective, may be groups or social practices that tend to serve broad, as opposed to narrow, interests and do so in ways that are both accepted and enduring. Institutionalization is thus the process by which unstable or loosely patterned actions are socially integrated to form orderly stable social structures. Cultural superiority and elitism on the part of Whites has become so thoroughly institutionalized into the country's social fabric that many people, including educators, fail to recognize some of the many guises it assumes. For example, opinion polls often have White and people of color as having different opinions about whether Blacks receive equal pay for equal work and about the treatment received by Blacks in the criminal justice system. A recent NAACP Legal Defense Fund and Education study (Johnson, 1989) conducted by Lou Harris, reported that 67 percent of Whites agreed that equal pay generally prevailed and 66 percent of Blacks disagreed. Similarly, 61 percent of Whites rejected the idea that the criminal justice system treated Blacks unequally, a statement that was supported by 80 percent of Blacks. Further a Newsweek poll (Black and White, 1988) pointed out that there are significant differences between the ways Blacks and Whites view their relationships in society today, especially in comparison to each other (p. 23).

Formalization is another part of the institutionalization process. Our nation's founders, by putting into words the belief that slaves were not full persons, gave formal recognition and acceptance to the idea that some cultures were superior to others. They were among those who helped to institutionalize the White cultural superiority and elitism in American society and schools. As the social practice of promoting White cultural superiority and elitism became formalized, those who had an interest in its maintenance tended to take steps to conserve it. Laws, as a product of formalization, were not sufficient. To become institutionalized, social practice must be integrated into the personal value systems of those who will enforce and perpetuate it. Our public schools provide an excellent vehicle for this part of the institutionalization process.

The schools and teachers as chief instruments of this process became very important in the institutionalization of White cultural superiority. Schools took advantage of the opportunity provided by compulsory attendance statutes to instill in the minds of this country's youth that segregating people of color from White people was legally sanctioned and socially important. This segregation also permitted and encouraged the teaching of racist concepts necessary to espouse and maintain White cultural superiority. Some of the teaching of White cultural superiority was quite direct through the use of biased textbooks and the absence of teachers and administrators of color. Other parts of this process were less obvious, such as the misuse of testing instruments to inaccurately and unjustly label and negatively classify students of color. Let's review some of the process.

Some of the most respected institutions in society give legal and social credence to the White cultural superiority and racism of these undertakings. For example, in 1896, the Supreme Court case *Plessy vs. Ferguson* established the "separate but equal" doctrine that gave direction to racial relationships in the schools and greatly influenced social behaviors through out the country. This doctrine also said, in policy and practice to students of color, that their culture was not respected and, therefore, could not be beside (in persons or artifacts) the White culture in school. *Plessy* also institutionalized practices that were supported by the Federal Courts permitting White students to be provided with school buildings, equipment, and personnel before Black schools were. As Ihle (1986), tells us:

> Three years after *Plessy*, Blacks in Richmond County in Georgia brought suit because the county, which operated a high school for White girls and another for White boys, closed the only Black high school in order to accommodate more Blacks in the elementary grades. The Supreme Court chose not to get involved; despite the clear violation of the "separate but equal" doctrine, the Court ruled in *Cumming v. Richmond County Board of Education* (1899) that federal law was not broken and the county could allocate its tax money as it saw fit. (p. 2)

The renunciation of *Plessy*, with the passage of *Brown* in 1954, laid the legal foundations to mandate integration of public schools and civil rights guarantees during the 1960s. These measures were supposed to give a positive and sustaining direction to race relations in this country and allow the cultures of *all* of the students to come together and have equity and equality in the classroom. A recent report, however, by Orfield (1987), points out this is not happening. Orfield reported that there has been little overall change in the segregation of Black students since the early 1970s. He argued that three of the four administrations since 1968 were openly hostile to urban desegregation orders, and the Carter Administration "took few initiatives in the field" (p. 1). Hispanics, Orfield observed, are becoming more segregated in virtually all parts of the country, and in almost every period in the 16 years that national data have been collected.

Additionally, he argued that the most segregated states in 1984 were states that previously fought for integration. The old hotbeds of abolitionism, Illinois and Michigan, and a pioneer in modern civil rights law, New York, have a very large number of Black students but a smaller proportion of Blacks in their total enrollment than many southern states. Furthermore, Orfield (1987) noted:

> The States are primarily distinctive in terms of the scale of their segregated resident areas, the fragmentation of school districts within their large metropolises, and the lack of any city-suburban desegregation plans in any of their largest urban communities--New York City, Chicago, and Detroit. (p. 5)

Textbooks should provide the opportunity for all cultures to be seen as equal and to be celebrated in the classroom, but this is not and has not been the case. In the 18th and 19th centuries, textbooks promoted cultural denigration and inferiority of people of color. Native Americans were depicted as noble savages, fond of cruelty, and as having little regard for civilization. Blacks were characterized as "gay, thoughtless, unintelligent, and subject to violent passion" (Ellison, 1964; Gould, 1978). Asian-Americans, when they were present, were frequently presented in a manner that implied they were socially inferior (see for example, Committee on the Study of Teaching Materials, 1949). The culture of all people of color was summarily degraded.

The decades following the 1950s witnessed some positive change in the portrayal of the culture of people of color in textbooks, but by no means and in no way was their treatment equal to that of White people. A study of textbooks published by the Michigan Department of Public Instruction in 1963 concluded:

> Minority children frequently grow up unaware of great portions of prideful heritage, partly because of omissions or distortions in school books. When this occurrence is coupled with other kinds of discrimination confronted in our society, they are left with the feeling of frustration, negative self-image, and distrust for education, and a cynicism regarding democracy. (p. 2)

In 1970, Michael Kane reported a study of people of color in textbooks. He observed that there was some recent improvement in the way Blacks were presented. The historical references to Native Americans had improved, but their portrayal in contemporary society was weak or inaccurate. Kane also reported that there was little improvement in the treatment of Asian-Americans, and little attention was paid to Spanish-speaking Americans.

Other studies of textbooks (see, for example, Butterfield, Demos, Grant, Moy, and Perez, 1979, Costo and Henry, 1970. Dunfee (1974) reported similar results. Women of color and Hispanic-Americans are underrepresented in text materials and are rarely shown in decision-making positions, and the culture of people of color in comparison to the White culture was not portrayed in an esteemed and celebrated manner. Recently, Sleeter and Grant (1989) analyzed 47 textbooks presently in use in grades K-9 for social studies, reading and language arts, science, and mathematics with copyright dates between 1980 and 1987. They found that textbooks still show the White culture as superior to the culture of people of color. Whites, by far, receive the most attention, are presented in the greatest number of roles, and dominate the story line and list of accomplishments. Furthermore, the Sleeter and Grant study reveal that the cultures of different groups of color were rarely shown in relationship to one another, just in relationship to Whites. For example, Black cowboys of the West were not discussed interacting with Native Americans, Asian-Americans, or Mexican Americans, who also lived at that time in that region of the country.

Teachers of color are important role models for *all students, especially students of color.*

> The race and background of their teachers tells them something about power and authority in contemporary America. . . . These messages influence children's attitudes toward school, their academic accomplishments, and their views of their own and others' intrinsic worth. The views they form in school about justice and fairness also influence their future citizenship. (Carnegie Forum, 1986, p. 79)

By their presence they indicate to students of color that their cultural group is respected and academically capable. For example, interviews conducted with students of color have shown that many of them are particularly pleased and gratified when they have a teacher of their own background, especially when they are in a school where there are few teachers of color on the staff (Grant and Sleeter, 1986). Similarly, Bandura and Walters (1963), G. Grant (1978), and others have pointed out the importance of role models in conveying positive messages. The teacher is an important role model to the students in his/her class, and, although successful teaching is not determined by a person's color, many educators are arguing that the growing shortage of teachers of color will have a negative impact on all students, especially students of color.[7]

For example, Gordon (1988) and other scholars of color argued that one of the major educational battles in the 21st century will be for the hearts and minds of people of color.

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[7] I would encourage departments of teacher education to have their students see *Stand and Deliver*. This film will provide an excellent opportunity to discuss being in teaching and the desire and dedication of teachers.

She pointed out that "people of color are having a difficult time realizing the American dream because they are not only battling against racism, but an evolved culture that combines racism with elitism, an inherited empirically founded Spencerian rationale, and capitalism" (p. 156). Gordon's observation does not bode well for how the culture of students of color is received in school. In fact, she argued that "African-American parents and educators must supplement school learning with after-school or weekend programs focused on their *specific needs and cultural idiosyncracies*" (italics added, p. 157).

As the 1980s began, the shortage of teachers of color was emerging at an alarming rate. In public schools, 91.6 percent of the teachers were White, 7.8 percent were Black, and 0.7 were classified as others. By 1986, 89.6 percent were White, 6.97 percent were Black, and 3.4 percent were classified as others (Harris and Harris, 1988). As we move into the 1990s, there are few indicators that the shortage of teachers of color, particularly Black teachers, will get better. The dismal figures and the forecast of the number of educators of color working in public schools suggest that the culture of people of color is, and probably will remain, just as proportionally underrepresented.

One of the most devious and vocal forms of communications to students of color about their culture are school tests. Educators used tests to sort, select, and keep students whose culture was different from their own in "their place" for decades. Spring (1972) argues that the testing movement was started by social scientists to identify the low culture immigrating "ignorant hordes" at the turn of the 20th century. The schools were to stamp out the evil of ignorance by educating immigrants, especially those who were not from northern Europe endowed with Anglo-Saxon cultural traditions and language. The IQ test, especially, has provided a means for educators to attack and castigate the culture of students of color. Test developer Lewis Terman's (1916) following words are still too often the policy and practice heard in school today.

> Their dullness seems to be racial, or at least inherent in the family stocks from which they come. The fact that one meets this type with such extraordinary frequency among Indians, Mexicans, and Negroes suggests quite forcibly that the whole question of racial differences in mental traits will have to be taken up anew. . . . There will be discovered enormously significant racial differences . . . which cannot be wiped out by any schemes of mental culture. Children of this group should be segregated in special classes . . . they cannot master abstractions, but they can often be made efficient workers. (pp. 27-28)

An example of why Terman's words are not outdated today is that the 1960 version of Terman's Stanford-Binet intelligence test, which was still being used in the 1980s, asked students to determine "Which is prettier?" and counterposed portraits of non-White people against those of White Anglo-Saxon individuals. The correct choice, according to Terman, is the Anglo-Saxon representative in both examples.

Tracking in schools is another way the culture of students of color is undermined in schools. For example, in the California court in 1972, plaintiffs in *Larry vs. Riles* had to challenge the validity of two intelligence tests to measure accurately the intelligence of Black children because, as a result of these tests, a much higher percentage of Black than White children was being tracked to special education classes. Although Blacks represented only 28 percent of all children attending school in California, they constituted 66 percent of the children in special education programs. Psychologists brought in to testify for the defense demonstrated that the IQ tests were unreliable instruments for judging the ability of Black students to learn, because the tests assume that children are familiar with the customs and language of White middle-class Americans.

More recently, Oakes (1985) argued that tracking based on bias can influence the student of color's self-concept. She pointed out that students, even in the early grades, know which ones are in the top group, average group, and low group, and why. Oakes (1985) explained it as follows:

> Rather than help students to feel more comfortable about themselves, the tracking process seems to foster lowered self-esteem among these teenagers. Further exacerbating these native self-perceptions are the attitudes of many teachers and other students toward those in the lower tracks. Once placed in low classes, students are usually seen by others in the school as dumb. . . . Closely related to students' self-evaluations are their aspirations for the future and the educational plans they make. Students in low track classes have been found to have lower aspirations and more often to have their plans for the future frustrated. (p. 8)

Our purpose thus far has been to remind you that, in policy and practice, historically and presently, schools undermine and marginalize the culture of students of color. Thus, policy and practices designed to provide teachers with information about the culture of students of color 'must' also provide them with a knowledge and understanding of the history discussed above to avoid putting students of color in academic and social harm's way.

Teachers and Culture

For teachers to use effectively any information that they receive about the culture of their students, they must understand their own biographies and enculturation and how these give direction to their thoughts and actions regarding the educational information they receive. The psychological literature is replete with accounts of peoples' actions being directed by their past behavior (see, for example, Adler, 1963; Bandura, 1971; Bronfenbrenner, 1979; Erikson, 1963; Gould, 1978; Okun, 1984). The nightly news, talk shows, and the popular press regularly provide accounts of the influence of past behavior on current actions. For example, we often hear or read about how a person who was abused as a child becomes an abuser of his or her children. Similarly, the rejection of Bork's nomination to the Supreme Court was based on his past actions toward civil rights and the beliefs by his opponents that his past actions were indicative of his future dealings with civil rights litigation.

Our concerns about the enculturation of teachers should be just as energized as were the concerns over Bork, for Bork had an opportunity to face and respond to those who questioned his background and past actions. Most students of color are not provided such an opportunity. Many teachers don't have substantive conversations with their students about their life experiences and ambitions. Nor do they inquire into students' cultural knowledge about the academic and social aspects of schooling (see, for example, Grant and Sleeter, 1986; Sleeter and Grant, 1989). Teachers often label students of color academic and social misfits and place or leave them on a track that will lead to a culture of poverty and a life of despair.

What do we know about the biography of the teachers to whom we want to give this cultural information? Will the information be used to provide important and useful insights into learning styles of students of color? Will this information be used to perpetuate ideas from the cultural deficit hypothesis and encourage teachers to believe that these students have deficits and negative differences and are, therefore, not as academically capable of learning as White students? These are important and timely questions, given the dropout rates and poor achievement scores in many schools that students of color attend. Also, anyone who has done an in-depth study of urban schooling, or of a school where there is a significant enrollment of students of color, is aware of how these students often do not receive the best teaching and social and academic challenges because of their cultural background (see, for example, Gouldner, 1978; Grant and Sleeter, 1986; Payne, 1984).

Recently, educators have begun to pursue the area of biography and autobiography to better understand teachers and their teachings. They are using "life history" methodologies to understand teacher socialization and its implication for the classroom. Zeichner and Gore (in press) saw promise for the methodologies in helping to explain why teachers teach as they do. Zeichner and Gore argued that "these interpretations and critical studies have begun to provide us with rich information about the ways in which teachers' perspectives are rooted in the variety of personal, financial, religious, political, and cultural experience they bring to teaching" (p. 21).

Many of these teachers' perspectives are shaped by their enculturation in society. What has society been "saying" to its citizens about people of color that could impact a teacher's biography? Let's see. There have been positive gains in civil rights and race relations that could positively influence the biography of teachers toward students of color, but there has also been and continues to be too much negative influence regarding people of color. Society, while using equal opportunity rhetoric and demonstrating some evidence of color blindness and fairness, is still very racist and promotes White cultural superiority.

Cobbs (1988), a Black psychiatrist, informed us of how we, as a society and individually, deal with racism:

> Individually and collectively, Americans continue to be passive in acquiring any knowledge about the psychology of race. We underestimate its implications for how and with whom we conduct our lives. Most of us, when confronted with racial attitudes in any form, fall back on a comfortable intellectual laziness which elevates stereotypes to facts, and converts individual behavior to group characteristics. This, I believe, is normal human behavior. (p. 64)

Let's examine some of society's institutions with which teachers interact to see how people of color are perceived and treated. In journalism--the Fourth Estate--the American Society of Newspaper Editors reports that only 7.02 percent of journalists at daily newspapers are Asian-American, American Indian, Hispanic, or Black. More devastating is that 55 percent of the daily newspapers employ no journalists of color. Furthermore, in broadcasting, 15 percent of news jobs were held by Blacks in 1979; in 1986, that figure was down to 13 percent, and those in the business fear the decline is continuing, especially among Black males, (*Why Economists*, 1988).

In politics, although people of color are more active and playing a broader role in local and state politics in some regions of the country, the national level shows they have very little political muscle and are severely underrepresented in the power structure. Among the U.S. senators presently in office, two are Asian-American males; no present senator is Native American, Hispanic, or Black. The House of Representatives includes 22 Blacks (5.5 percent of the total membership), 12 Hispanics (2.75 percent of the total membership), and 5 Asian-American or Pacific Islanders (1 percent of the total membership).

In education and income in 1980, Black adults in the United States had completed an average of 12 years of schooling, just half-a-year less than the average number of years completed by White adults, but the average Black family earned only 59 percent as much as the average White family. Moreover, the income gap between Blacks and Whites had diminished by only 1 percent between 1967 and 1979 (U.S. Department of Commerce, 1981). More recently, according to the Center for Budget and Policy Priorities, the median family income of Blacks declined in the last decade from 59 percent of that of Whites to 56 percent (*Why Economists*, 1988). Furthermore, the unemployment rate for Blacks was more than twice that for Whites, a situation that has remained unchanged for two decades (U. S. Department of Commerce, 1979).

In housing, there have been numerous articles describing the poor housing conditions for people of color, especially the poor among them. Some articles argue that new housing construction for the poor has come to a virtual halt (*Decent Affordable Housing*, 1989). Other articles describe housing where poor people of color have to live as "hell" (*What It's Like*, 1987). And, still other articles point out that, in the housing market, racial steering is still evident in some areas (*Steering Blacks*, 1987a). How do teachers receive this information? Do they believe that the reason people of color live in racially segregated, inferior housing is because they don't want to work and have a better life? Do they believe that living in poverty is linked to culture? Many of the White teachers at both the preservice and inservice levels find a good deal of credibility in the victim-blaming hypothesis. This occurs, in part, because the history of oppression toward people of color has been omitted or conveyed to them in a desensitized manner.

The education profession is similar to society in institutionalizing racism. There is a long history, as we noted above, of how people of color have been marginalized or kept out of the social, political, and economic system. Therefore, it is necessary for teachers to analyze their biographies in order to determine how the enculturation process influenced them about race, class, and gender issues in regard to other cultures. For example, numerous narratives written by White teachers explain how their own life experiences were often a barrier to the schooling of students of color.

Decker (1969), a beginning teacher, described how an urban school presented a world completely new to her and students whom she didn't understand. The noise level at the school and being immersed in a Black world were all new to her. She said, "I was struck, . . . by the blackness. Being immersed in a Negro world was new to me, and in the dim, artificial light of the corridors, faces seemed to disappear. It struck me funny. I laughed for days" (p. 37). She further observed that it was difficult to understand what the students were saying, that there was a language barrier between the students and her. She explained, "It was Christmas before I could understand them without watching mouths." Decker's background and life experience were very different from those of the students she worked with. Speaking about the teachers who taught her, she said,

> Teachers were such gray people--gray suits, gray skin, gray personalities. They taught from yellowed notes they'd made up thirty years ago, *and hated all the Negroes and Jews that were moving to the Philadelphia main line*[italics added]. Things just weren't what they used to be, what with the new element and all." (p. 22)

On entering the profession, many new teachers' backgrounds and life experiences are more similar to Decker's than, they argue, to the students they will teach. According to a recent AACTE report, approximately 80 percent of the new teaching force grew up in suburban and rural settings and are strongly desirous of teaching only in that kind of environment (American Association of Colleges for Teacher Education, 1987). The differences in life experiences between students and teachers causes teachers to experience culture shock.

Parkay (1983), a neophyte White teacher, described in her narrative the culture shock and fears she experienced working with Black students:

> During my first year at DuSable [a high school on Chicago's southside] I was frequently very anxious and frightened. On occasion, I even had nightmares about the place. I despaired of ever understanding or accepting the students' behavior and attitudes that were so strange and threatening to me. I experienced what anthropologists and sociologists have termed "culture shock." (p.18)

Parkay (1983) listed several other fears about the school that she said contributed to her culture shock--fear of being manipulated, fear of aggressive, intrusive behavior; fear of encirclement and loss of autonomy; and fear of violent primitive behavior. In very explicit words, she illuminated my concerns about a teacher's biography and the need for teachers to understand themselves in relationship to the culture of people of color. She said, "If the lower class school to which a teacher is assigned contains a significant percentage of Black students, most middle class teachers are apt to experience anxiety related to their students' race" (p. 52).

Canfield (1970) provided a similar experience of how biography impacts a teacher's classroom behavior. Being temporarily assigned to work in a Chicago inner city school, Canfield described the desire to teach and frustrations of teaching that were present, in part, because of his acculturation:

> Every minute I taught in the classrooms, and as I walked through the halls and met kids on the street, I wondered if I were being accepted, if they thought I was real. . . . I was . . . driven to be accepted by what Black militants would term my own mad fancies and guilt feelings as a White liberal. (p. 37)

Canfield (1970) also acknowledged, like Parkay (1983), the difference in the biographies of the teachers and the students they teach. He observed,

> Most, yet not all, of the teachers in the school were irrelevant to the lives of the students whom they taught. A student would quickly identify the teacher with his or her subject and block them both out of his mind. (p. 38)

Longstreet (1978) also provided an insightful account of how her lack of understanding of the culture of students she was teaching turned them off and annoyed her:

> Many teachers at Harlem school confessed to a feeling of "strangeness" at the school. . . . These theoretical concerns are sometimes not seemingly as important as the more overt and direct effects on teachers of being in the new cultural setting. Virtually no permanent friendships existed between Black and White teachers, and even the informal lunchroom talk fests revealed White and Black teachers to be aloof from one another. Some White teachers attributed the lack of response in the children as based in anti-White feelings. And some of the Black teachers concluded that the failure of children to learn was grounded in anti-Black feelings among White teachers. These feelings were

> a microcosmic reflection of the larger societal macrocosm where similar reactions are engendered. (p. 11)

Other nonbiographical studies of classroom life have also pointed out how teachers' biographies impacts their actions. For example, based on a three-year ethnographers' study of junior high school, Grant and Sleeter (1986) argued that one of the major barriers to students of color receiving a quality education was the teachers biographies, their lack of understanding--of race, class, gender, and disability issues--and their teacher preparation experience (both preservice and inservice).

The above narratives allow us to use the teachers' own words to point out the importance of acculturation and biography for influencing teacher behavior. It is too academic and socially costly to students of color to be taught by teachers who do not know who they are and what they are about. It is also unprofessional, improper, and inappropriate for educational decision makers to allow unprepared teachers to attempt to help others when these teachers must first help themselves.

Uncertainty and Contradiction in the Literature

Thus far, I have argued that giving teachers cultural information about students is premature and problematic, because teachers need to have an understanding of their own biographies and how past life experiences regarding race, class, and gender influence present action. I have also argued that teachers need to have an understanding of how the school (the educational system) has a history of degrading the culture of students of color. There is a third reason why giving teachers information on the culture of students of color is problematic. It is problematic because there is a great deal of debate and uncertainty in the educational literature regarding culture, ethnicity, and learning. This debate and uncertainty make it difficult to decide and raise additional questions regarding what we should tell teachers about culture and learning. For example, some educators argue that a students' cultural background influences learning, and others argue that cultural information about students can lead to stereotyping. Of these perspectives and others, which ones should we stress? Should we provide the teachers with all the perspectives and then have them form their own opinion? Or, has a larger question surfaced out of this debate? For now, let's briefly discuss some of the perspectives.

Some educators (Boykin, 1986; Carbo and Hodges, 1988; Erickson, 1987; Gibson, 1987; Kendall, 1983; McDermott, 1987; Trueba, 1988) argue that a student's cultural background influences learning. However, some of these educators, for example Kendall (1983) argues that

> there is indeed a fine line between awareness of potential effects of ethnicity on learning styles and expecting a child of a particular ethnic group to behave in a particular way. Ideally, the teacher does not view any child as a cultural

> or ethnic representative but responds to each one as an individual for whom culture or ethnicity is merely one aspect of her or his personality. . . . It is essential that teachers not make assumptions about a child's learning style solely on the basis of the child's cultural heritage. (pp. 13-15)

Ward (1973) argues that culture and language program the mind. Trueba (1988), in a recent criticism of cultural ecologists--especially Ogbu and his classification of minority groups as "autonomous," "immigrant," or "castelike"--argues that there is a very close relationship between language, culture, and cognition; therefore, a theory is needed to integrate conceptually the explanation of successful learning activities, especially for children who find themselves in cultural transition. However, Ogbu (1987) counters that language and cultural differences do not influence groups unless they are stratified. He also points out that failure to recognize the differences between primary and secondary cultural differences often results in global and stereotyped descriptions of minority-group cultures. Lundsteen (1978) points out that achievement motivation is different from culture to culture.

Other educators claim that cultural explanations of differential achievement can provide a basis for stereotypes. For example, Weisner, Gallimore, and Jordan (1988) indicate that cultural differences often result in global and stereotypical descriptions of minority group cultures. Some educators, for example, Romero (1987), state that individuals may not always be shaped by culture but may simply represent idiosyncratic behavior particular to that individual or family. Brunner (1973) also states that culture does not produce completely divergent unrelated modes of thinking.

Other educators (Gordon, 1979; Morris, 1978; Stodolsky, 1967) argue that ethnicity is a factor that can determine cognitive style. However, Sprangler also points out that acculturation may be a factor in determining cognitive style, and there is a great deal of variation between groups. Some educators point out that social class is an important determinant. Gordon (1979) and Shade (1981, 1982) claim that a student's social class can confound the impact of ethnicity. Hale (1982), drawing upon some of the work of Havinghurst (1976), argues that within a complex society social class and ethnicity interact in the shaping of human behavior, but the interaction is a complex process. Rossi (1961) earlier made a similar observation: "While . . . studies . . . unfortunately find socio-economic status playing a role in achievement, it is not entirely clear how it does so" (p. 269). These educators were arguing, it could be interpreted, in principle, that it is valuable not only to explain to teachers the importance of cultural influences on students of color, but also that culture must be understood in relationship to socioeconomic status.

Finally, there are some educators who question the existence of ethnic styles. Weinberg (1977), in his analysis of ethnicity and learning, argues that the existence of ethnic learning styles is problematic. Similarly, Anderson (1977) and Henderson (1980) point out that cognitive style studies are contradictory. Anderson shows that cognition is due to the situation, and that school, teacher, and student traits, not cognitive preference, are the cause of a lack of school services. Banks (1976) also indicates that there are numerous reasons affecting students of color: "Findings are as diverse as are the theoretical and methodological approaches that generate them" (p. 6).

What of this information should be provided to teachers--some, all, or leave it up to them to make their own determination? I am not advocating the de-skilling of teachers as far as cultural information about students of color is concerned, but one should point out the problematic nature of the information and the varying points of view. I would argue that teachers need to be provided with all of this information, and they also need to be provided with the time and resources to gain an understanding of what it means to their teaching.

Given this time for analysis they may question "the question" and ask, Is this debate so static that it can be answered from a singular perspective? They may argue that some real questions aren't being examined, for example, Why should teachers be given a recipe for working with students' culture, when students' ascribed characteristics are so diverse and they represent so many groups within groups? Students are Asian-Americans, Black Americans, Hispanic-Americans, Native Americans, and White Americans, male and female from different socioeconomic classes, and they represent a wide range of cultural diversity.

They may ask, Why aren't students considered as individuals, who have been influenced by their particular background and circumstances and, therefore, need to be taught with this consideration in mind? These and many other questions that teachers would raise move us closer to the heart of this dilemma. It is not the major point to give teachers a cultural recipe for working with students of color, but to get them to realize that in order to work successfully with any students, especially students whose race and socioeconomic status are different than their own, they will need to raise many questions, starting with questions about themselves. Recipes for teaching students of color can become a means of transmitting racist discourse and practice.

Finally, it is important for educators to realize that the educational problems experienced by students of color cannot be resolved by seeing them mainly as the cause for their lack of educational success. Educators must understand that *they* (and the overall structures of school and society) play a major role in the lack of academic success of students of color. Until that is understood educational success will escape all involved.

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CULTURAL EMBEDDEDNESS: THE ROLE OF CULTURE ON MINORITY STUDENTS' ACQUISITION OF ENGLISH LITERACY

Henry T. Trueba[*]

In the tradition of educational anthropology and of recent studies (see Spindler and Spindler, 1987a, 1987b; Trueba, 1989a; Trueba and Delgado-Gaitan, 1988) this paper presents an interdisciplinary approach to the understanding of culture in learning processes in the context of an applied research project with Hispanic high school students. The empowering effect of this English literacy intervention in potential dropouts raises issues about the need to train teachers to use the cultural background of minority students in the organization of instructional activities. According to the U. S. Department of Commerce,

> - The Hispanic civilian noninstitutional population increased by 4.3 million (or 30 percent) from 1980 to 1987.
> - The educational attainment of Hispanics has improved since 1982, but lags behind that of non-Hispanics.
> - Hispanic men and women continue to earn less than non-Hispanics.
> - Hispanic families continue to have less total money income than non-Hispanic families.
> - The poverty rate of Spanish-origin families in 1986 was almost three times as high as that of non-Hispanic families.
> - The poverty rate for Hispanic families has not changed significantly between 1981 and 1986, but because of population growth, the number of Hispanic families below the poverty level in 1986 was 24 percent higher than that in 1981 (U. S. Department of Commerce, 1987, p. 1).

The Bureau of the Census, according to the same report, shows a total Hispanic population of 18 million with 11.8 million Mexicans, 2.3 million Puerto Ricans, 1 million Cubans, 2.1 million Central and South Americans, and 1.6 million other Hispanics. Mexicans constitute 63 percent of the Hispanics, Puerto Ricans 12 percent, Central and South Americans 11 percent, Cubans 5 percent and others 8 percent (U. S. Department of Commerce, 1987, p. 2). We do not have accurate measure of dropouts among Hispanics for a number of complex reasons dealing with classification problems and lack of empirical data. Some school districts (Los Angeles, for example--personal communication from Los

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Angeles School District Office) estimate that a minimum of 45 percent of Hispanic students never finish the 10th grade.

Educational researchers have not been able to present adequate justification for the differential achievement levels of minorities. Some have presented controversial theories pinpointing genetic (Dunn, 1987; Jensen, 1981) or cultural ecological arguments (Ogbu, 1978, 1987a, 1987b) to explain underachievement. Attempts have been made to analyze these explanations (Trueba, 1987a, 1988b, 1988c) and consider their application to teacher education (Trueba, 1989a).

Culture and Failure

Failure to learn is related to communication skills that develop in the context of culturally congruent and meaningful social exchanges. It is not an individual failure; it is a failure of the sociocultural system that denies a child the opportunity for meaningful social intercourse and, thus, for cognitive development. As such, academic failure is fully understandable only in its macrohistorical, social, economic and political context. Failure in learning is not caused by a single social institution, such as the school or the family (Cole and Griffin, 1983, p. 71).

Both academic success and academic failure are socially constructed phenomena. Failure to learn is a consequence of given sociocultural system:

> Working within preexisting social norms and role relationships, teachers and students collaborate to create the linguistic and social conditions under which students fail to learn. . . . Misunderstandings of one another at that time can lead to assessment of students as less than able or interested learners. (Florio-Ruane, 1988, p. 1)

The acquisition of academic knowledge is not necessarily any more difficult than the acquisition of the concrete knowledge required for effective everyday social interaction. Thus, some researchers believe that resistance to learning should be viewed as students' rejection of cultural values and academic demands placed on them by school personnel. Erickson (1984) discussed resistance to academic achievement on the part of alienated students in cultural transition.

Recent studies on English literacy acquisition have analyzed the use of culturally and linguistically congruent instructional approaches that smooth the transition from the home to the school learning environment (Au and Jordan [1981b], Tharp and Gallimore [1989] in the Kamehameha Schools of Hawaii and Southern California; Delgado-Gaitan [1987a, 1987b] with Mexican children in Northern and Central California; and Trueba [1989a] with Hispanics and Indochinese). In contrast, other studies have shown the consequences of the use of approaches which are culturally incongruent or meaningless (for example, Richards [1987] among the Mayan children of Guatemala; Hornberger [1988] among the Quechua children of Peru; Macias [1987] among the Papago; and Deyhle [1987] among the Navajo). What is significant about these studies is that they show the intimate relationship between language and culture in the adjustment of minority students in the schools.

George and Louise Spindler (1982), who have consistently viewed education as a phenomenon of cultural transmission--implying the inculcation of specific values--have recently called our attention to educators' need for *reflective cultural analysis* in order to take into account unconscious biases and cultural ethnocentrism. In the tradition of the Spindlers' cross-cultural comparisons (1982, 1987a), Fujita and Sano (1988) have compared and contrasted American and Japanese day-care centers, using the Spindlers' Reflective Cross-Cultural Interview Technique. They filmed and analyzed videotapes of Japanese and American teachers; then they asked one group of teachers to interpret the behavior of the other group. This study has permitted researchers to reflect on the ethnocentrism and projection of cultural values reflected in day-care activities; that is, socialization for "independence" or for "nurturing tolerance and cooperation," characterizing American and Japanese teachers respectively. Another approach in looking at academic socialization for achievement has been the one taken by Borish (1988) who uses the Spindlers' model of "compression and decompression" cycles. He focuses on the socialization of high school kibbutz young adults getting ready to enter the Israeli armed forces who endure intense labor experiences "in their winter of their discontent."

DeVos, for example, has used projective techniques, in combination with ethnographic methods to penetrate complex layers of personality structure and motivational processes (1973, 1982, 1983; DeVos and Wagatsuma, 1966). Suarez-Orozco (1987, in press), using cultural ecological approaches and projective techniques, shows that the success of Central-American refugee children is based on a motivation to achieve. This motivation is as an expression of their profound commitment to assist and make proud their parents or family members left behind in war-torn Central America. These research methods have been applied at the broader macrosociological, political, and historical levels, as well as at the microstructural levels of interaction (Ogbu, 1978, 1987a, 1987b; Suarez-Orozco, 1987, in press).

The Nature or the Role of Culture in Learning

Culture plays a similar role in both successful learning, and the "social accomplishment" of academic failure and minority alienation (Florio-Ruane, 1988) is very similar. Culture provides the motivation to achieve either success or failure. That is particularly true of the ultimate failure of dropping out and rejecting educational institutions: their knowledge, norms, and values. How is this possible? Why is there such a conflict of cultural values? The explanation must be found within the larger sociocultural, historical, and political context of minority participation in mainstream social institutions. The indiscriminate use and application of minority group taxonomies (designations of "castelike," "autonomous," and "immigrant types") by cultural ecologists for entire ethnic or minority groups may have objectionable theoretical and practical consequences (Trueba, 1988b, pp. 271-287). These taxonomies are based on theories of differential school achievement which do not allow for either individual or collective change in status and therefore tend to stereotype entire ethnic groups. Furthermore, these theories do not explain the conversion of failure into success among "castelike" minorities described as follows:

> *Castelike* or *involuntary minorities* are people who were *originally brought into United States society involuntarily* through slavery, conquest, or colonization. Thereafter, these minorities were relegated to menial positions and denied true assimilation into mainstream society. American Indians, black Americans, and Native Hawaiians are examples. In the case of Mexican Americans, those who later immigrated from Mexico were assigned the status of the original conquered group in the southwestern United States, with whom they came to share a sense of peoplehood or collective identity (Ogbu, 1987b, p. 321).

For example, the task of documenting empirically that all or most Mexican-Americans were colonized or entered this country involuntarily, or that they have been denied true assimilation into mainstream America is enormous. There is abundant evidence of fairly rapid assimilation of many, while many more continue to arrive of their own free will seeking economic and educational opportunities. Thus, while we can seek in the home culture an explanation for the response of a minority to the academic demands placed by school and society, we must search for explanations that do not stereotype minorities or preempt our search. An interdisciplinary approach may be the solution.

The Cultural Foundations or Cognitive Development

Soviet psychologists led by Vygotsky (1962, 1978), and Neo-Vygotskians (see references in Tharp and Gallimore, 1989; and in Wertsch, 1985) have provided us with forceful arguments for linking the development of higher mental functions to social activities. Vygotsky viewed language as crucial for the development of thinking skills, and language control as a measure of mental development. His emphasis on the learner's role in determining his/her area of most possible cognitive development (or "zone of proximal development") is related to the role that culture plays in communication during learning activities. Wertsch's position (1987) is that culture is instrumental in the selection and use of specific communicative strategies in adult-child interaction, as well as in the organization of cognitive tasks.

He indicates that "people privilege the use of one mediational means over others" and that "we need to combine the analysis of collectively organized mediational means with the analysis of interpsychological functioning." Consequently, if "choice of mediational means is a major determinant of how thinking and speaking can proceed, then processes whereby groups make decisions (either implicitly or explicitly) about these means should become a focus of our research" (Wertsch, 1987, pp. 20-21). In brief, according to Wertsch, culture either determines or at least facilitates a conscious, collective choice of communicative strategies. Thus if we want to study memory, thinking, attention, or other facets of human consciousness "we must begin by recognizing the sociohistorical and cultural embeddedness of the subjects as well as [the] investigators involved" (pp. 21-22).

Within this theoretical framework, symbolic systems are presumed to mediate between the mind and outside reality, and the development of the higher psychological functions is a necessary condition for school achievement. That reality, however, is determined by cultural knowledge transferred from one generation to another and by universal psychological principles which go beyond the individual. Furthermore, both linguistic and social skills are viewed as developing within the microsociological units in which children grow, such as the family, school, and peer groups.

Academic Achievement and Literacy

One can argue that effective English literacy instruction requires the transmission of cultural values and skills as much as the academic knowledge associated with mainstream American culture (Spindler and Spindler, 1982, 1987b). The work by Cook-Gumperz (1986), Gumpez (1982, 1986), and Gumperz and Hymes (1964) has forced us to reconceptualize the interrelationships between communication, literacy, and culture which form a single symbolic system used in adapting to new cultural contexts and changing with the cumulative experiences in people's lives. As such, literacy is seen as a "socially constructed phenomenon" (Cook-Gumperz, 1986, p. 1) consisting of culture-specific symbols developed for communicative purposes. As such, literacy depends on the economic and political institutions determining power hierarchies and access to resources; technological, industrial and military complexes not only depend on overall levels of literacy in a given society, but they also determine the quality of instruction in schools and the nature of curriculum.

According to Goodenough (1976), culture "is made up of the concepts, beliefs, and principles of action and organization" that a researcher finds enacted in the daily experiences of the members of that society (p. 5). However, as Frake (1964) points out the problem is not "to state what someone did but to specify the conditions under which it is culturally appropriate to anticipate that he, or persons occupying his role, will render an equivalent performance" (p. 112). It follows, therefore, that a good understanding of a culture requires a good theory predictive of behavior in a particular social setting. In other words, cultural knowledge and cultural values are at the basis of reasoning, inferencing, and interpreting meanings. There is an important distinction between cultural knowledge and cultural values in the acquisition of literacy skills. The task is to make sense of text as a message whose content takes meaning within the "concepts, beliefs and principles of action" alluded to by Goodenough.

To accomplish this task we must have knowledge of the codes of behavior (the cognitive dimensions of culture), but also we must share in the cultural values (the normative dimensions of culture) which invite us to engage in communication through text. In order to see the culture-specific cognitive and normative dimensions operating in the literacy activities of minority students, it is necessary to observe such literacy activities systematically, not exclusively in the constrained school settings but also at home (Delgado-Gaitan, 1989). The following discussion of a research project will help to illustrate the difficulties in creating culturally congruent literacy activities in the school setting, and the advantages of an interdisciplinary research approach.

The South San Diego Writing Project

The South San Diego Writing Project consisted of ethnographic data collected over period of four years (1980-84) in the San Diego South Bay area along the U. S.-Mexican border (Trueba, 1984, 1987b; Trueba, Moll, Diaz, and Diaz, 1984). The intent was to explore more effective ways of teaching Chicano youth how to write in English. The two high schools selected for the study had a 45 percent Chicano population and the lowest academic scores in the school district. Chicano students were not only socially isolated in the community and minimally exposed to English-speaking peers, but they were also economically isolated in barrios which were the settings for frequent violence and other gang activities. As we gathered the 12 volunteer teachers who wanted to work in our project, we found out that most of them lived away from the community in which they taught. All were eager to become effective writing instructors and teachers, but most of them felt that students were so unprepared and ignorant that the teacher was doomed to fail. Only 3 of the 12 teachers knew Spanish well.

The objectives of this applied research project, discussed with parents and teachers during an orientation, were to (a) improve the quantity and quality of English compositions, (b) encourage student participation and cooperation in writing activities, and (c) analyze in detail student response to English writing instruction. The specific demographic, socioeconomic, and political characteristics of the barrio, as well as the home language and culture of the students, were generally unknown and viewed as irrelevant by teachers. Given the history of low academic performance of Chicano youth in the local schools, teachers felt that students could not succeed in learning how to write in English. Researchers arranged for parents and teachers to meet and become acquainted with each other's culture.

Teachers were asked to organize their classrooms into small groups which eventually became cohesive work teams with full control of their own writing activities. They would explore possible topics, research them, develop data gathering instruments such as surveys and interview protocols, conduct actual interviews with peers and adults, discuss findings, and finally write cooperatively extended and complex essays. The students discovered that writing was no longer a futile school exercise designed by teachers for their own purposes but a meaningful activity and a means for exchanging important ideas with specific audiences and for expressing their own feelings. Students realized that their individual and collective voices can make a difference in public opinion and in the quality of life at school. Thus Chicano high school students not only significantly sharpened their communicative skills but realized that these skills are a powerful instrument in voicing individual and collective concerns. Teachers would often express their surprise: "I am impressed. Look!"--they said as they shared their students' compositions. A teacher wrote in her diary: "This [the unexpected high performance of students] was a very successful lesson for me in many ways. It furthers my belief that if what is taught is important in the mind of the learner, much more will truly be learned" (Trueba 1987b, p. 131). The analysis of the project was limited to a theoretical discussion of Vygotsky's cognitive development in the context of writing curriculum, without attempting to account for the psychosocial factors that generated the strong motivation leading to high achievement and literacy levels. The importance of the peer group as a working unit providing moral support during the learning process, especially for young Chicanos undergoing rapid changes at home, would have required more systematic study of the Mexican families' cultural knowledge and values, as well as the processes of integration of school knowledge and values.

Writing gradually became easier and more rewarding to students. Teachers and researchers learned more about students' home life and their aspirations through the English compositions. Then we celebrated our success and enthusiastically assumed the role of "experts" on writing focusing on technical matters. As one teacher noticed, "The more controversial and relevant they make the topic, the more willing the students are to unite and write well. The more complicated the assignment is, the better the responses" (Trueba, 1987b, pp. 246). In our analysis we forgot an important psychological principle advanced by anthropologists, that in order to understand motivation behind expressed values "one must deal with the universal emotions of love, fear, and hate" and that "culture, from one psychological viewpoint, is a mode of expressing, in all their complexity, these primary emotions, which are aroused by inner biological urges or occur as reactions to specific outer stimuli" (DeVos, 1973, pp. 63).

It has taken several years to realize that it is precisely in young Chicanos' need to express their feelings of love, hate, and fear that their motivation to write began to develop. More importantly, this need was most appropriately met within the peer group, because cooperation and teamwork is culturally the preferred mode of academic activity for Mexican youth. Writing groups offered Chicano students a unique opportunity both to express their collective feelings and to reinforce a cultural value acquired in the home. Furthermore, there was a positive side effect: High academic performance in an English writing class had a positive impact on their overall performance in school, thus stimulating student motivation to produce better English compositions. In the end, writing became a vehicle for restoring the credibility Chicanos lacked among other students, and, further, as a means for gaining political representation in the school. Violence or other gang activities, low-riding[9] and other conspicuous activities of "cholos"[10] or "vatos locos"[11] which had been the common expressions of Chicano youth power, were effectively replaced by writing as a legitimate expression of power, not of brute force power, but of intellectual power to function within the existing social institutions. Here is the essence of empowerment in a democratic society.

Mexican and Mexican-American families often find themselves isolated from mainstream society, yet they must face drastic changes in a new world whose language and culture is not understandable to them. Children growing up in these families are subject to high levels of anxiety related to their status as illegal aliens in extreme poverty and their inability to communicate in English with mainstream society. The dramatic change from failure to success in acquiring English literacy cannot be explained in terms of "castelike" concepts and cultural ecological theory which would have predicted the permanent failure of these students (Ogbu, 1978, 1987a, 1987b). The explanation for the unexpected academic success of "vatos locos" rests on their newly discovered meaning of English literacy activities if used for purposes of genuine communication and political representation within the social institutions in which they live, particularly within the school.

It was indeed a discovery for the researchers and teachers as well. Writing can become a powerful instrument in the hands of students precisely because it gives them a voice in an academic world in which they have little control of their lives. The recognition, status, and personal satisfaction embedded in the ability to communicate well through writing were a joint accomplishment of students, teachers, and researchers all working together within the political arena of school achievement. This is how the internal rewards for English literacy acquisition functions. The journey from failure to success should help us understand the social construction of failure. The next paragraphs examine an aspect of the social construction of the dropout, the ultimate academic failure.

An Emic Concept or Minority Dropout

The conversion of failure into success is empirically demonstrable, whether we can explain it theoretically or not. Unfortunately, it is a rare fact. However, it is important to revise, not only the theories of failure and success but their very components, especially the concepts created by academicians and imposed on students. The concept of dropout is particularly inadequate because it misrepresents the social reality of students' school experience. The literature does not distinguish the diverse types of dropouts, nor their views of school and reasons for abandoning school within the context of their home culture. Ethnographic fieldwork among dropouts, however, seems to indicate that minority students distinguish clearly different types of dropouts.

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[9] "Low-riding" refers to a cultural tradition of Mexican-American teenagers riding in cars specially designed to have low shocks which give the cars the appearance of moving close to the pavement. Associated with this tradition is the conspicuous speeding, racing, and gang fighting.

[10] "Cholos" is a term to describe teenage Mexicans and Filippinos who dress with ponchos, bands on their heads, and baggy pants and are viewed as disenfranchised and marginal in school and society. It is also a derogatory term for ethnic teenagers who refuse to apply themselves to serious academic tasks.

[11] "Vatos locos" is equivalent to crazy kids. Vato is a term borrowed from the Pachuco language in the 1930s and currently used by Chicanos in greeting each others: "Hi, Vato, what's up?" Vatos locos also refers to marginalized youngsters who challenge the system in a violent way. (Cholos do not necessarily become involved in violence; Vatos locos are more likely to do so, as well as to get into drugs, etc.)

A study conducted in the San Joaquin Valley (Trueba, 1988a) suggests that Chicano students make conscious and deliberate decisions to withdraw permanently from school for reasons beyond their control (relocation of family, economic need, personal safety, etc.). These students are referred to as "discontinuers" in contrast to those pressured to leave school against their will who are called "pushed outs." In general, both discontinuers and pushed outs tend to leave school permanently and are presumed by educators to be deprived of the economic opportunities given to individuals with higher educational level. We do not have good studies of the actual outcomes. We know that some of the discontinuers are doing well economically and plan to return to school later on. There is a profound difference between pushed outs and discontinuers with regard to their degree of alienation and their views of school. The cycles of alienation, marginality, and illiteracy for some minority students are clearly related to their experience and interpretation of cultural conflict within the school, which are also guided by parental perceptions of schools (Wilson, 1989).

Culture is closely related to the acquisition of knowledge and motivation to achieve, both at the social level (as it affects the family, school and society), as well as at the personal level (as it affects the structure of participation in learning events within specific contexts). The role of culture in students' perception of school activities as enhancing cultural goals and values acquired in the home is instrumental in converting failure into success. But students' cultural perceptions of school as oppressive and destructive of the home culture can have devastating effects (Wilson, 1989). Therefore, culture must be recognized by researchers as a key factor in the study of minority achievement.

Dropout Research for Empowerment

What should be the focus of dropout research? Where and how should we explore the role of culture in literacy and dropout phenomena? What is the expected impact of such research? Researchers are often overwhelmed with these questions and opt for a detached and safe position; they become "pure researchers" and reject applied research as unscientific. Others explore intervention-oriented research convinced that science can also grow from the study of interventions. The work of many anthropologists and psychologists suggests that intervention and explanatory research are complementary and that the dichotomy between basic and applied research was the result of a political and historical accident more than the logical distribution of research activities (Trueba, 1988b, pp. 273-274).

Applied and basic research must be conducted in both formal and informal learning settings where students manipulate symbolic systems within their sociocultural environment. The immediate as well as the broader contexts of academic activities in specific learning settings must be studied. They are essential in understanding the organization of behavior and the type of student participation in learning activities. The analysis of literacy activities, for example, and the patterns of student participation should lead us to a more comprehensive view of "cultural embeddedness" in minority education. Teachers' knowledge of the home language and culture can be highly instrumental in understanding any communication gaps between the parents or students and school personnel.

The school cultural environment and the organization of classroom work should reflect sensitivity to the ethnic cultures of minority students and this way maximize their participation in learning activities. Minority children can generate their own text materials based on their home experiences as a bridge to engaging in the school culture (Trueba, 1989b). The analysis of learning activities in the home is most important because there inquiry strategies, logical inferencing, and cultural congruence occur naturally (see studies by Delgado-Gaitan, 1987a, 1987b, 1989). This analysis can provide insights into possible linkages between self- empowerment efforts on the part of minority students and their parents and the role of school personnel in such empowerment through literacy activities. Empowerment research has developed significantly in the last five years through the integration of cultural anthropology and the sociohistorical school of psychology led by Vygotsky. However, its application to teacher education is barely beginning.

Researchers need teachers' knowledge and experience in order to explore the role of culture with the intent of converting minority failure into success. Specifically they need the following:

1. Compassion for linguistic minority children who are not responsible for their academic predicament and their struggles in adjusting to a new cultural and linguistic environment.

2. Commitment to the principles of educational equity, particularly to that of respect for the home language and culture of linguistic minority children.

3. Theoretical flexibility and persistence in the pursuit of the elusive role of culture in both the acquisition of knowledge and values both in school and away from school.

The interdisciplinary crossroads of sound research approaches in anthropology and psychology must be inspired by teachers' pedagogical principles and their humane approach to the education of ALL children. These approaches will ultimately enhance our understanding of students' culture and its role in the process of academic empowerment within the context of American democratic society.

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WHAT DO TEACHERS NEED TO KNOW ABOUT CULTURAL DIVERSITY? RESTORING SUBJECT MATTER TO THE PICTURE

G. Williamson McDiarmid[12]

The I-Thou-It Triangle

Most discussions of what teachers need to know about cultural diversity focus on what teachers need to know about learners--their interactional or learning styles, their social norms and cultural values, their relations to social and political structures. Noticeably absent from the discussion has been a consideration of the relationship among the teacher, the learner, and the subject matter. I propose to restore subject matter to considerations of what teachers need to know about cultural diversity. What teachers most need to know about diverse learners concerns their relationship to knowledge, the meaning and value they have constructed out of their experiences outside of school and their encounters with the subject matters inside of schools.

David Hawkins (1974) has argued that what distinguishes the teacher-learner relationship from other adult-child relationships is their mutual involvement with something outside of themselves. Hawkins writes, "Adult and children, like adults with each other, can associate well only in worthy interests and pursuits, only through a community of subject matter and engagement which extends *beyond* the circle of intimacy" (p. 49). To represent this relationship, Hawkins proposes what he calls the I-Thou-It triangle, in which the I--the teacher--the Thou--the learner--and the It--the subject matter--constitute the three corners.

This representation seems apt because it not only keeps subject matter in the picture but places it on an equal basis with the teacher and the learner. Rather than taken for granted or an afterthought, subject matter is, in the triangle, to be considered in any discussion of what teachers need to know, regardless of the cultural or ethnic background of the teachers and learners. What does change, what varies from one context to the next, from one classroom to the next, and, indeed, from one subject matter to the next are the factors that condition these relationships. I will focus my remarks on what considerations condition relationships between learners and subject matter, teachers and subject matter, and teachers and learners. These factors that condition the relationships in the I-Thou-It triangle are, I contend, what teachers need to know about cultural diversity. In particular, I want to focus on the value learners place on subject matter knowledge and the influences on that evaluation and the critical role that teachers' understanding of their learners plays in the ways in which they represent their subject matters. As Hawkins notes, the quality of the adult-child relationship hinges on their mutual engagement "in worthy interests and pursuits." Teachers are responsible for representing the subject matters as "worthy interests and pursuits," most especially to learners whose experience both inside and outside of school leads them to believe that subject matter knowledge is worthless.

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In thinking about this issue, I have drawn on several sources of data. The first is the Teacher Education and Teacher Learning study of the National Center for Research on Teacher Education. By surveying, interviewing, and observing prospective teachers, we have been trying to figure out what teachers and prospective teachers know and what they learn from teacher education programs about teaching mathematics and writing to diverse learners. A second source is my experience as a classroom teacher at the secondary, middle school, and elementary levels in a variety of cultures--Greek, African, Alaska Native, European, and the rural South. Finally, as a teacher educator, I have tried to understand how my mostly white, mostly middle-class students think about teaching learners with whom they share few common experiences, either in or out school, few values, few expectations.

A couple of notes of caution: I would not want anyone to get the impression that I am arguing that, because most teachers take university courses in the subject matters they teach, they will know what they need to know to teach culturally diverse children. Nothing could be further from the truth. Data from our Teacher Education and Teacher Learning Study, as well as other research, shows fairly conclusive that prospective teachers lack the kind of understanding they need of such subjects as mathematics if they are to create the multiple representations necessary to address the diversity of prior experiences and understandings present in classrooms (Ball and McDiarmid, in press; McDiarmid, in press). Nor does the data indicate that more courses of the kind currently available at most universities are likely to remedy the problem: Liberal arts mathematics majors are almost as frequently unable to generate appropriate representations for fundamental concepts such as division as are education majors (Ball, 1988). Take no comfort in the fact that we are apparently paying attention to teachers' subject matter knowledge; the kind of knowledge to which we are paying attention is unlikely to address the needs of diverse students. Evidence of this is to be found in persistently low test scores and graduation rates, and declining college attendance rates among such populations as blacks, Hispanics, and Native Americans.

In what follows, I will argue that teachers need to know about and address the values and understandings their learners bring with them; that this knowledge is as critical as the teacher's knowledge of the subject matter to the teacher's capacity to represent content in a variety of ways so that learners with a variety of initial values and understanding will all have opportunities to understand; and that teachers also need to know how the organizational arrangements of school such as ability grouping and tracking can shape both what different students can learn and how they can understand the content to which they are exposed. Yet, even as I argue for such knowledge and understanding, I am aware that many of the issues that teachers face in teaching cultural diverse learners are genuine dilemmas. I remember a spirited discussion with a group of fourth-grade Eskimo students occasioned by the breakdown of the school walk-in cooler. We talked about freon gas, gases in general, and speculated on what the compressor did to the gas. When I asked, "So, why did the walk-in breakdown?" one of the students who had been most involved in the conversation replied, "Ghosts." She was not joking.

Spirits were part and parcel of the life of the Yu'pik Eskimo people. How do I handle this? Do I gently point out that there may be physical causes? Do I laugh it off? Do I ignore it? What role did these beliefs play in my students thinking about any number of topics? Did I need to address the issue once and for all, knowing that it was part of the framework for understanding students brought to whatever they encounter in school? What kind of trouble would this get me into with the students, with the community, with my fellow teachers who were also Yu'pik?

Such dilemmas are commonplace in the experience of teachers who work with culturally diverse students. Knowing and understanding subject matter and learners does not resolve for us the dilemmas of teaching culturally different children. Nor does it solve the dilemma that the children who most need the knowledge, understandings, and skills that teachers could provide are the same children who are least likely to value school knowledge. Yet, without the knowledge and understandings for which I am arguing, teachers are woefully ill-equipped to struggle with these dilemmas. Rather than seeing such knowledge as a solution to the dilemmas of teaching culturally diverse learners, I see them as the bare necessities.

What Conditions Learners' Relationships to the Subject Matters?

The Valuation of School Knowledge

Many learners view the knowledge taught in school as having little if anything to do with them, their friends, and family. They don't know where the information and ideas in their textbooks and about which their teachers talk come from, why they need to learn these things, and what such things have to do with them and the world in which they live. For some students, the disembodied and alien nature of what they are expected to learn is less problematic than it is for others. Some students grow up believing, as an article of faith, that school knowledge and doing well in school are important and are rewarded. The examples such learners see around them of people who have gone to school, gotten good grades, continued on to college and, in some cases, professional school, and made financially and socially rewarding careers sustains them in this belief. The peer culture, made up of like-minded students, tends to reinforce the importance of learning what is taught in schools. These learners rarely question the ultimate value of the knowledge they encounter in schools; they take it as it comes, try to remember what their teachers and the textbooks say, and reproduce as best they can what they've learned on various assessments.

For other students, particularly for many poor and nonwhite learners, evidence of the value of learning school knowledge is scant. They may know few people who have done well in school and continued their education. If they know such people, they are likely to consider them anomalies, weirdos, "dweebs" who cravenly conform to the expectations of the teachers and administration. In their study of an all-black high school here in Washington, D.C., Signithia Fordham and John Ogbu found that "peer group pressures against academic striving take many forms, including labeling (e.g., "brainiac" for students who receive good grades in their courses), exclusion from peer activities or ostracism, and physical assault" (cited in Ravitch, 1989.) Schooling and school knowledge are, at best, to be endured.

These students, like those who view school knowledge as important, see no relationship between themselves and what they are expected to learn. These unengaged youth, however, fail to see, in the world in which they live, any justification for learning school knowledge. Counting among their family and friends few who have followed the schooling route to financial and social success, these learners can't imagine themselves doing so. When I interviewed the mother of several teenagers as part of a study of why so few Native Alaskans pursue careers in the health professions, she told me: "One reason we don't get into some fields is because we don't know what's available--nobody around here is into it." She was not referring to the lack of information as much as to the lack of personal relationships with people who are health professionals. Native Alaskan students literally could not imagine themselves as health professionals.

While many poor and nonwhite learners have little direct contact with those who have benefited from schooling, their own daily confrontation with schooling underlines the senselessness of most of what they do. Grant and Sleeter (1988), discussing the views of 24 youths from a multiethnic neighborhood whom they followed from middle-school to high school graduation, explain:

> Students' everyday experience with school taught them that it was boring and that the content was irrelevant to daily life. It may be important for attaining a career goal, but if the medicine was bitter, why ask for more than the doctor prescribes? So the students accepted minimal homework and a low involvement with class work, and developed other interests and behavior patterns, centering largely around sports, that filled their time and probably would have caused them to resist a sudden increase in school work (a "what if" they never faced). (p. 36)

Robert Everhart (1983), in his study of students in a working class junior high school, offers numerous examples of students' encounters with unconnected knowledge being learned for its own sake. For instance, Everhart records an exchange in Mrs. Marcy's English class over vocabulary words. Everhart notes that in this class students were "expected to memorize definitions rather than to understand what a word and its relations to other words meant":

> "To look over carefully or examine in detail is what, class? Roger?"
> "I don't know."
> "Dale?"
> "Canvass."
> "Right. Mike, to make or utter a chuckling sound?"
> "Uh, ch-, chat, chatal or something like that."
> "Close, who can help him? All right, Tina?"
> "Chortle."
> "Good, 'Alice chortled when she saw his clothes that day.' How about the word for modern or not long past? Yes, Philip?"
> "Recent."
> "Yes. Tina, you have a question?"
> "Yeah, how are we going to have these words on the test tomorrow; I mean will you give us the definition and we'll have to fill in the word?"
> "Yes, that's the way we've always done it and I don't see any reason to change now. OK, how about the word for concise or pithy?"
> Linda immediately raised her hand and volunteered the word terse.
> "Good, Linda." Linda turned to Tina next to her, smiled triumphantly, and said, "I'll always remember that one because she uses the word 'pithy'." (p. 58)

A comparison of how vocabulary is learned inside and outside of schools points up not merely the artificial and disembodied nature of activities such as Everhart describes but their ineffectiveness as well (Miller and Gildea, 1987). Not only is the meaning of a word dependent on its context, the learners' understanding of that meaning is similarly dependent on the learners' prior experience and knowledge as well as the classroom context in which the word is used (Brown, Collins, and Duguid, 1989). Confronted with a succession of similar encounters with disembodied information that they are expected to remember and reproduce, unengaged learners are confirmed over and over again in their view that school knowledge is an end in itself, unconnected to the world outside of school.

In sum, learners' view of subject matter is conditioned by (a) the value such knowledge has in their immediate world and (b) the direct experience of the subject matter in the context of school. While many students experience subject matter knowledge as unconnected to any thing outside itself, as disembodied information that must be remembered--some students see evidence in their immediate context that they will eventually profit from learning what schools and teachers teach. Other students, however, lacking such evidence, find the knowledge they encounter in schools neither compelling in itself nor apparently a means to greater power in or control over their environment.

Knowledge, Skills, and Commitments Valued in the Learners' Context

Closely related to the valuation of school knowledge are the knowledge, skills, and commitments that are valued in the learners' context. Such local knowledge provides a critical standard that learners--and others in the learners' environment, such as parents--use to evaluate the knowledge available in schools. Such knowledge is also likely to inform the understandings that learners bring to their encounters with subject matter knowledge.

Students' Prior Knowledge of and Experience with the Subject Matter

Students' relationship to the subject matter is also conditioned by their prior encounters with the subject matter. Given the account of learners' experience with subject matter in school sketched previously, many learners have developed views of various subject matters as unconnected bodies of facts, rules, and procedures. Subsequent encounters with the subject matter are conditioned by this view of subject matter. Learners learn to expect their encounters with subject matter knowledge to be boring and unconnected. This is particularly salient for teachers who would like to create opportunities for students to understand subject matter knowledge as uncertain, contested, historically and socially constructed, and traceable to our efforts to understand the social and natural world. Even though many students find their encounters with subject matter knowledge boring and mechanical, they come to regard the school's definition of knowledge as the only one, in the absence of competing ideas. Consequently, teachers who choose to depart from such a conception of knowledge and skills may meet with resistance from learners and their parents.

What Conditions Teachers' Relationship to the Subject Matter?

Views of How Subject Matter Is Taught and Learned

Teachers are themselves products of schools that are probably similar to those in which they teach, at least in the ways knowledge is defined and taught. Evidence that teaching practices have been pretty stable throughout this century seems fairly persuasive (Cuban, 1984). Despite the dizzying rate at which information is expanding, the view that the knowledge pupils should learn in schools is fixed, agreed upon, and reproducible on various assessments pervades not merely schools but our society as a whole (Cohen, 1989).

Teachers' experiences with knowledge at colleges and universities do not appear to differ greatly from the experiences they had in school (Bennett, 1984; Boyer, 1987;

McDiarmid, in press). Knowledge in most disciplines appears to be presented as a body of facts, procedures, theories, and ideas that need to be remembered. As a consequence, teachers' knowledge of subject matter may differ from that of their students in the sheer number of facts and ideas in a subject that they can recall rather than in the quality of their understanding. The latter has to do with the connections among ideas and information within a field as well as between disciplines; the nature of knowledge in the field; understanding about how new knowledge is generated and tested in a given field and who--that is what categories or classes of people--have helped generate this knowledge; and notions about how the knowledge in the subject matter is taught and learned (Ball and McDiarmid, in press).

Teachers' Representations of Subject Matter

In teaching, teachers represent their understanding of the subject matter to students through a variety of media. These include the topics, questions, information, and ideas they select to present to students; the sequence and manner in which they present these substantive matters, including the kinds of discourse they encourage and the kinds of activities they organize; the examples, illustrations, analogies, metaphors, and so on that they employ to represent their understanding to students; the textbooks and other materials that they and the students use; and what they chose to evaluate and how the evaluation is carried out. The fact that teachers represent their subject matter is, in and of itself, neither good nor bad; it just happens.

Where do teachers' representations come from? Teachers either adopt or adapt existing representations or generate their own. Textbooks both represent the subject matter and are an important source of representations; teachers frequently use examples from the textbook in teaching. Another common source of representations is teachers' remembrances of their own teachers and courses, especially their methods courses.

A critical issue is how teachers go about deciding which representations they will use. Teachers must evaluate various representations they could use in teaching a topic, procedure, or idea. The criteria teachers bring to bear include not merely how faithfully the story, analogy, diagram, experiment, or metaphor reflects the understanding of the idea shared by those in the discipline but, of equal importance, the opportunities the representation creates for different learners to understand the idea. Consequently, representations depend both on teachers' understanding of subject matter and on their understanding of the learners they teach.

Teachers' capacity to evaluate the appropriateness of the representations they make of their subject matter depends, then, on their view of learners as well as on their understanding of the learners' relationship to the subject matter. Representations need to take into account what learners are already likely to know and understand about the subject matter as well as the experiences and knowledge they bring with them from their environment. Representation may be appropriate either because they draw on learners' initial understandings--or, if these initial understandings of the subject contravene those of most people in the field--because they force the learners to confront their taken-for-granted understandings (Floden, Buchmann, and Schwille, 1987).

Teachers' Understanding of the Relationship of the Subject Matters to the World

The various subject matters that make up the school curriculum come out of our accumulated experience with the natural and social world. In school, learners encounter knowledge in situ; unless presented with the opportunity to do so, they are unlikely to understand the origins of the knowledge they are taught. Part of understanding a subject is understanding its origins as well as its connections with other subjects and the world beyond school.

Teachers may treat knowledge just as learners do--as a given, a part of the landscape that is school, at best tenuously and vaguely related to the world beyond the school walls. When we asked prospective teachers what they would say to students who complained about having to learn regrouping in addition since they had calculators, few could come up with reasons likely to convince unengaged students (Neufeld, 1988). One prospective teacher suggested, lamely,

> Sometimes your calculator's batteries run out. And you need to balance your checkbook. . . . I'd say you're not always going to have your calculator with you. (p. 10)

Another, reflecting the view that the somewhat circular logic that what is taught in school is important because schools teach and test it, offered the following rejoinder:

> When you're taking' different tests, you're not allowed to have a calculator. So what are you going to do then? (p. 11)

Alternatively, teachers may treat knowledge as the product of human endeavor--of efforts to enrich lives and pockets, solve problems and mysteries, explore and exploit, harness or shape the environment, liberate or subjugate, grow, gather, or earn one's daily bread. Mathematics has developed from efforts to understand both our world and its place in the universe. And while most Europeans lived under the pale of superstitions, a distinctly non-Western people, the Arabs, developed algebra and nurtured the ideas of Euclid, Pythagoras, and Ptolemy.

Teachers' understanding of the origins of the subject matters, of who has contributed to the development of ideas in the field, and of the connections to the broader world determines in large part their view of their own relationship to the subject matter and the relationship of their learners. Teachers who see themselves and their students capable of generating as well as consuming knowledge represent the subject matter in fundamentally different ways than do teachers who see knowledge as received and themselves and their students are consumers. Teachers and students who debate whether zero is odd or even, what it means to divide 3 by 16, or who undertake to write a history of the buildings in their neighborhood or of the local transportation system develop together conceptions of mathematics and history in which they are included, in which they come to view themselves as capable of doing what experts in the field do.

Teachers' relationship to the subject matters is, consequently, conditioned by several factors. Teachers, from their past experience as students in school and at university, as well as from the prevailing ideas and beliefs in the society in which they have lived, have notions about how particular subject matter is taught and learned. These notions govern both what teachers view as legitimate teacherly activities in a given subject as well as how they think the subject is best learned, what constitutes learning in the field, and how learning is assessed. Through the choices of goals and materials, activities and examples, teachers communicate to learners their understanding of the subject matters. In selecting or generating representations of a subject, teachers draw not only on their understanding of the subject matter but their knowledge of their learners as well. The representations teachers use depend on their knowledge of their learners' prior experience and understandings of the subject matter as well as their knowledge of what their learners are likely to find difficult.

As this discussion demonstrates, teachers' subject matter knowledge for teaching involves teachers' understandings of the relationship of the learners to the subject matter. Representations, however faithful they may be to the subject matter, are useful and appropriate only in so far as they address the understandings and experience of the learners for whom they are intended. As classrooms contain learners who may differ dramatically in their past experiences with the subject matter, in their initial understandings, in the value they place on the subject matter, in their view of themselves as doers of the subject matter, in their understanding of the relationship between the subject matter and the world outside of school, teachers must be able to generate a variety of representations for any given idea. The differences the teacher needs to be concerned about are the differences in students' relationships with the subject matter. These are the differences neglected in preparing teachers to teach.

The Teacher-Learner Relationship

The third side of Hawkins triangle represents the relationship of the teacher and the learner. Much of the literature on cultural diversity has focused on this relationship, in particular on the interactions between culturally different teachers and learners, interactions that the various actors interpret according to their experiences, beliefs, and values. I would like to take a different tack, premised on Hawkins' contention that it is the mutual concern with subject matter that distinguishes the teacher-learner relationship from other adult-child relationships. Consequently, I focus on what about the teacher-learner relationship is likely to influence their shared interest in subject matter. As in all relationships, perceptions and beliefs travel in two directions.

Teacher Beliefs About Culturally Different Students' Capacities to Learn Specific Subject Matter

In discussing teachers beliefs, I will be relying heavily on data from the Teacher Education and Learning to Teach study of the National Center for Research on Teacher Education. While most of the data comes from preservice teacher education programs, our early analyses indicate that on most dimensions, teachers' beliefs and views do not change dramatically in response to their teacher education program. I will focus, in keeping with Hawkins' notion of the I-Thou-It triangle, on teachers' views and beliefs of learners as learners of subject matter.

The first thing to note about prospective teachers' views of learners is that most, like most practicing teachers we interviewed, reject stereotyping of students even when these stereotypes are not derogatory. Teachers are quick to point out that each child is different, is unique. Indeed, this belief is so widely held and proclaimed as to constitute a dogma. When we asked them what kinds of differences among learners are important to consider in teaching, prospective teachers spurned ethnicity and social class, asserting that all students should be treated the same. Differences that they did think teachers ought to take into account were differences in personality and behavior--that is, are kids shy, disruptive, motivated and so on (Paine, 1988)?

For prospective teachers we have interviewed, what follows from the dogma of the uniqueness of each child is a concomitant belief that each child has individual needs which it is the teachers' responsibility to address. The best way of addressing these needs is by individualizing classroom tasks--indeed, 7 out 10 prospective teachers in our sample thought teachers ought to tailor instruction to individual differences (Paine, 1988). Bear in mind that these are the same people who unequivocally and consistently asserted the imperative to treat all children the same regardless of their ethnic or social class background. When presented with a scenario in which a teacher has addressed the differences she saw by assigning students different tasks, only 1 out of 10 in our sample disapproved of individualizing instruction, even though the tasks represented the subject in radically different ways and provided opportunities to learn clearly different knowledge and skills.

What is going on here? On the one hand, these prospective teachers are proclaiming their commitment to equal treatment for all and on the other they approve of very unequal opportunities to learn subject matter. Are they merely confused or frankly prejudiced? Are they unwitting ciphers in a society that reproduces itself over and over again by ensuring that students from different social classes learn their place in the economic order?

What these teachers believe is, in fact, consistent with the way in which society has dealt with differences among students throughout this century (Cohen, 1984). Even as schools were opening their doors to an increasingly diverse student population, internally schools were differentiating among these students. As the number of immigrant children attending schools in the U.S. progressed geometrically during the first two decades of this century, tracking and ability grouping became part of the warp and woof of life and organization in schools (Cohen, 1984). The desegregation of schools in the South and in northern cities coincided, in the 1960s and early 1970s, with the advent of Title I and Special Education programs, further differentiating children. In the 1970s, various schemes for individualized education represented--for reformers, administrators, and teachers alike--the latest remedy for whatever ails American schools.

So, the idea of treating everyone the same by treating everyone differently is not a paradox for which prospective teachers can claim authorship. Sanctioned by its embodiment in school policy and organization and, more recently, in instruction, this paradoxical view of treating differences among learners conditions how teachers view learners. If all learners are different, what are the sources of these differences, according to prospective teachers? As I noted above, teachers are quick to deny that ethnicity or social class, per se, are differences to which teachers need attend in teaching. Instead, they talk about either personality factors--for example, shyness--or motivation. Motivation is a key concept in prospective teachers views of differences among students. Some trace motivation back to the learner's families as in the following:

> "Higher SES kids usually come from more motivated backgrounds, education-wise. You would have to know that if you got an entire class of low-SES kids, you are going to have to work on motivation much more than if you are working with upper middle-class kids." (Paine, 1988, p. 9)

Others, more than 4 out of 10, seem to think that students are responsible for their own lack of motivation; that is, they have a bad attitude. One prospective teacher, in reaction to one of the teaching scenarios on our interview, justified a teacher's isolating a student who is described in the scenario as being "so active he sometimes disrupts others" as follows:

> "He's, you know, he's, he's grown up with this attitude and you know he's not going to get rid of it in one year. She can help ya know and she can possibly get him going along with the class and not disrupting the class and making progress, but she's not going to solve the problem by herself." (McDiarmid, 1989)

By defining the problem as a one of motivation, prospective teachers have also defined the remedy: The teacher must motivate students to learn. How do prospective teachers believe students can be motivated to learn? Either by praise or what they call "positive reinforcement" or by getting the students to view the subject matter of school as "fun."

The importance of praising students and positively reinforcing appropriate behaviors, like the notion that every child is unique, approaches the category of dogma among teachers. In the scenario mentioned above which describes a teacher's treatment of three different students, including descriptions of the tasks she assigns each, of each child's home situation, and actions that typify the teacher's interaction with each, prospective teachers rarely commented on the tasks the children were assigned or their backgrounds; rather, they were most likely to focus on the teachers' use of praise. As one prospective teacher explained about the teachers' decision to individualize,

> "[The teacher] knows what students are capable of doing what tasks. And those that are below average and having a hard time, she's giving a lot of comfort to (Georgia). . . .She's letting James know that he is doing a good job even though he is not capable of keeping up with the rest of the students." (McDiarmid, 1989)

What is troubling about these prospective teachers' views is their lack of attention to students as learners of subject matter and teachers' responsibilities. More teachers and prospective teachers believe that deficiencies in the learners--lack of a good home life, ability, or enthusiasm--account for school failures than believe that poor teaching is responsible. Most seem to believe that the differences that matter in school are individual differences of personality and attitude and that the way to address these is by individualizing--that is, differentiating the tasks that students do. At the same time, there seems to be little awareness that differentiating tasks--assigning tasks on the basis of students' perceived ability--may result in unequal opportunities to learn the subject matter.

Students' Views of Teachers as Representatives of the Subject Matter

Teachers, particularly, elementary teachers, may not think of themselves as representatives of their subject matter but that is what they are for many students. Teachers who require students to do row after row and ditto after ditto of mathematical computations, who insist that students always work alone, who talk about mathematics only during arithmetic and only in the context of the textbook, who respond to student complaints that repetitious practice computations are boring with statements such as, "That's the way math is," communicate to students something about the nature of the subject matter. Representing mathematics or science or history as a mechanical, solitary, and repetitious task is unlikely to engage learners much less help them develop an understanding of the subject matter.

Arguably, much of the success of teachers such as Jamie Escalante as portrayed by James Olmos in *Stand and Deliver* and Marva Collins is due to the emphasis they place, in their teaching, on their role as representatives of the subject matter they teach. For Escalante, mathematics is powerful, both as an intellectual tool and as a vehicle for maneuvering in society; for Collins, knowledge of literature and language are sources of power. Other teachers, like Magdalene Lampert, emphasize their role as people who think about, question, inquire into and discuss issues and topics in their subject matter (Lampert, in press). In either instance, these teachers are aware of themselves as representatives of the subject matter and conscious try to represent what they understand to be nature of the subject matter.

Conclusion

So what is it that teachers need to know about cultural diversity? Using Hawkins' representation of teaching as a three-cornered relationship among teachers, learners, and subject matter, I've argued that teachers need to know what conditions these various relationships:

Student-Subject Matter Relationships

1. Teachers need to know how school knowledge is valued in their learners' cultures--their peer, family, and community cultures. Resistance to school authority and knowledge among poor, working class, and minority youth is well documented.
2. Teachers need to know which knowledge, skills, and commitments are valued in the learners' culture. Such knowledge is critical to developing representations of subject matter that either bridge or confront the knowledge and understandings that learners bring with them.
3. Teachers need to know about students' prior knowledge of and experience with the subject matter. The frameworks of understanding, based on prior experience, that learners use to make sense out of new ideas and information are also critical if teachers are to represent their subject matter in ways that help students understand.

I can't leave these ideas without addressing the issue of where teachers learn these things. If teachers are to discover what their learners understand, value, and are curious about, they must create opportunities for learners to talk about these things in the context of the subject matter. Creating opportunities to talk and then listening to what learners have to say further communicates to students respect for them as people who both know things and who are capable of understanding even more.

Teacher-Subject Matter Relationship

1. Teachers' ideas about how a given subject matter is taught and learned determine, in part, the kinds of opportunities they create for learners to understand.
2. Because of differences in learners' prior experience and understandings, teachers need a repertoire of different representations for a given idea, concept, or procedure. Teachers' ability to generate or adapt representations and their capacity to judge the appropriateness of representations for different learners depends, probably equally, on their understanding of their subject matter and their knowledge of their learners.
3. Teachers understanding of the relationship of their subject matter to the world enables them to help students understand these connections. Such connections are critical to learners' need to see the relationship between what they are studying in school and the world in which they live. Such connections are critical if teachers are to help disadvantaged learners increase their control over and within their environment.

Teacher-Student Relationship

1. Teachers need to understand the role that they and schools play in limiting access to vital subject matter knowledge by addressing what they define as individual differences through organizational arrangements such as individualization, tracking, and ability grouping.
2. Teachers also need to know that, for learners, they are representatives of their subject matter. If they represent mathematics as repetitious drill and practice, if they express negative attitudes toward mathematics, their learners are likely to develop similar beliefs and attitudes.

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